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USSR REPORT
MILITARY AFFAIRS
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No. 3, March 1986

Except where indicated otherwise in the table of contents, the following is a complete translation of the Russian-language monthly journal ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, published in Moscow by the Ministry of Defense.

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FOREIGN MILITARY REVIEW

REGIONAL CONFLICTS IN IMPERIALISM'S PLANS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 3, Mar 86 (Signed to press 4 Mar 86) pp 7-14

[Article by Gen-Maj E. Dolgopolov, Candidate Philosophical Sciences; "Regional Conflicts in Imperialism's Plans"]

[Text] The sharpest problem now facing humanity--the problem of war and peace, is emphasized in the CPSU's new Draft Program. It is precisely for this reason that today there is no task more important for people than to preserve the peace and avoid a nuclear catastrophe, goals which, to a decisive degree could be served by limiting the arms race, primarily nuclear and in space, which was unleashed on U.S. initiative.

However, American imperialistic circles have still not abandoned the idea of gaining military superiority. In the United States, to oblige the military-industrial complex, a course is being pursued for the development of nuclear space resources and the quantitative accumulation and improvement of nuclear first-strike systems. All this is hidden by the propagandistic claims about the so-called "Star Wars" program's supposedly defensive character. Simultaneously in the West, a persistent attempt is being undertaken to relegate the problem of the cessation of the arms race to a secondary level and to concentrate attention on regional conflicts which supposedly are the main sources of the increased tension in the world.

At the same time, first, the causes of existing regional conflicts are grossly distorted: they are explained, not by objective, socio-economic and other conditions, but are reduced to rivalry between the East and the West. As Secretary of State George Shultz confirmed in December 1985, a confrontation between the U.S. and the USSR most likely can originate "as a result of this or that crisis in the developing countries." Starting from this interpretation, he justified the necessity for the accumulation of American armed forces both in Europe and in other regions of the world. A similar point of view--the echo of the imperial thinking, is to see habitually on political maps only "spheres of influence," and to deny the peoples' right of self determination.

The West is attempting to lay the blame for the exacerbation of the situation, in one or another of the regions, on the Soviet Union, the other socialist

countries, and on the forces of social and national liberation. Overlooked in all this, is the unwillingness of imperialist circles to abandon the customary anti-communist stereotypes, the tendency to justify their adventuristic policies by references to the imaginary intrigues of the USSR and the other fraternal socialist countries.

Secondly, such methods are being suggested for the resolution of regional conflicts which in fact would imply a capitulation of the revolutionary and democratic forces and submitting to the American "hawks" sanctions for the suppression of the national liberation movements. It is not by chance that recently in Washington they have begun to speak about the new "doctrine" "neoglobalism," or "low intensity conflicts," in harmony with which any government not accommodating the "neocrusaders" can become the object for the use of force by the United States. Moreover, for the activization of its subversive activities in the so-called "third world," imperialist circles are hoping to inflict "tangible strikes" on the USSR's internal and foreign policies and thus torpedo the Geneva Agreements, to ruin the possibility for strengthening the trust between the two countries. Simultaneously, Washington is striving to transform international arbitrariness and violence into a collective Western affair, and to embroil its military allies in a "new globalism."

In principle, imperialism's reactionary circles are attempting to set up the attainment of measures in the area of disarmament as a function of regional conflicts. Hidden behind this is the unwillingness to take the path of disarmament as well as the tendency to impose upon sovereign people a will foreign to them and such arrangements as would make it possible to support intensely unjust conditions of existence for certain countries at the expense of others, and using their human, spiritual and natural resources for individual governments' self-centered imperialist goals or aggressive groupings.

There is no denying that regional conflicts exert a distinct influence on the overall atmosphere of international relations. They are indeed critical, particularly when there is the threat of their proliferation in the nuclear era. However, these conflicts are by no means the "consequence of imposing ideology from without," as they are trying to assure in the U.S. but are generated primarily by the very nature of the exploiter regime; its relationship to dominion and subordination, oppression of the weak by the strong; and attempts to solve emerging problems by flagrant violence. "Tension and regional conflicts and even wars between various governments in this or that corner of the world," says M. S. Gorbachev, "extend by their roots both in the past and the present social and economic conditions of these countries and regions. To represent matters as though all these nodes of contradictions are the result of the rivalry of the East and the West, is not only incorrect, but also extremely dangerous."

Today's world of states which have been set free is a multifaceted total of sovereign states and peoples who have their own interests, their own aspirations, their own policies, traditions and dreams. Many of them are only reaching the road of independent development. Their first steps are being carried out under incredibly difficult conditions in overcoming the

consequences left by colonialism. Naturally, the hope of each people is to realize its own sovereign right in the political, economic and social spheres. But, to consider, as they do for example in the United States, that the whole world is one's own estate, means to demonstrate an imperial approach, a yearning for the force of arms to impede the inevitable process of renewal of the modern world.

Experience shows that regional conflicts spring up first of all whenever and wherever imperialism, not wishing to reckon with the political realities of the modern world, and, ignoring the will of sovereign peoples, strives to deprive them of the right to choose for themselves the path of development and threatens their security. Washington artificially stirs up local conflicts, which it itself has had a hand in fomenting, and kindles new [conflicts] anywhere the hegemonistic concepts of the U.S. ruling circles demand. This is the main cause of conflicts in the various regions of the world.

Despite widely-circulated declarations that the U.S., as it were, always supports the right of the people of each country to decide its own destiny, during two centuries it has unleashed more than 200 wars and colonial campaigns. The U.S. has been the initiator of or a participant in the majority of military conflicts since 1945. The bloody war in Vietnam, the multi-year blockade of Cuba, the violations of the lawful rights of the Palestinian people, the intervention in Lebanon, the armed seizure of defenseless Granada, the aggressive actions against Nicaragua--these are only a few of the innumerable evil deeds which remain the most shameful pages in the history of imperialism.

In our day, the secret and obvious, although undeclared, wars which American imperialism and its hirelings are conducting against the people of Afghanistan, Kampuchea, Nicaragua, Angola, Mozambique, Ethiopia, the Arab states and a number of other countries, have become the particularly dangerous manifestations of regional conflicts.

In Afghanistan, for example, immediately after the April revolution in 1978, which had freed the masses from a despotic regime, American imperialism chose to support the Afghan counterrevolution and the subversive actions against the peoples' power. True, at first Washington attempted in every way possible, to hide the participation of the U.S. in the armed intervention against the Afghan people, thoroughly concealing direct support for the counterrevolutionary gangs and handing it out for "humanitarian help to the refugees." However, at the present time, American official representatives at the highest levels publicly are calling for an increase in financial and military assistance to the Dushmani, whom they hypocritically call "freedom fighters." Its amount in FY86 was 470 million dollars. On the whole, the United States has spent, for the conduct of the undeclared war in Afghanistan, more than 1.5 billion dollars. By foreign press data, the strength of the American "advisors" in the camps of the Afghan counterrevolution on Pakistan territory exceeded 300 men. Simultaneously, the scale of direct participation by Americans in the undeclared war against the Afghan people is expanding. In the U.S., the recruiting stations for "veterans of the war in Vietnam and other wars" have been established to train anti-Afghan bandit formations. It is reported also that in the make up of a band, with weapons in hand, which

are emerging against the people's power in the DRA, are mercenaries--former American servicemen.

Imperialism's almost eight years of undeclared war against Afghanistan have brought incalculable poverty to its people. According to published press data, the damage suffered by the DRA economy is reaching 34 billion afghani which comprises three-fourths of all the state's investment in the economy for the 20 pre-revolutionary years. The bandits have destroyed or burned 2,000 schools, 130 hospitals, 100 medical centers, more than 250 mosques, put 14,000 km of telephone and telegraph lines out of commission, and killed tens of thousands of non-combatants.

The situation in the region has been heated up as a result of the ever-increasing active connection of Pakistan to the hegemonistic strivings of the U.S. The size of its armed forces is approaching the half-million mark, military expenditures in recent years have trippled and have exceeded two billion dollars. It serves as a home base for training bands and sending them into DRA territory. Pakistani armed forces subunits take part in combat operations on the side of the Dushmani and their servicemen are advisors to the ringleaders of the individual anti-Afghan groupings. Pakistani artillery conducts bombardments of peaceful Afghan villages, and Air Force aircraft violate Afghan air space. In the region of the Kyber Pass, regular government forces conduct punitive operations against desert tribes which demand putting an end to the use of their territory for inserting Dushmani bands into the DRA. It is impossible to forget the fact that the build up of the Islamabad muslims is being used to put pressure on India, and precisely here the terrorists carrying out their criminal acts on the territory of this country find refuge.

Imperialistic circles frustrate, in every way possible, the peaceful settlement of the problems around Afghanistan, which in addition could create conditions for the withdrawal from the DRA of the limited contingent of Soviet forces, introduced there at that country's government's request to protect its sovereignty from external aggression.

Also noteworthy is the U.S. policy regarding Kampuchea, which, as early as Washington's Vietnam adventure, had become the target of its aggressive actions. From 1969 through 1973, more than 539,000 tons of American bombs were dropped on that the country. More than 2 million people (out of 7 million) were made homeless and there were about 600,000 killed. In 1970, a right-wing pro-American military-type regime was imposed on the Kampuchean people, and before long, American subunits were introduced onto Kampuchean territory. They, together with the South Vietnam puppet regime, expanded punitive operations against the country's patriotic forces.

After that, the Kampuchean patriots, supported by Vietnamese volunteers, overthrew, in 1979, the murderous cliques of Pol Pot--(Ieng Sari)--(Kkhiey Samfana), guilty of genocide against their own people, Washington took under its tutelage the survivors of the Pol Pot gang who had entrenched themselves in Thailand. Those, on whose conscience rests the death of three million people innocent of any crime, are now called by Washington "insurgents" fighting for a "just cause." From year to year, there is an increase in

supplying the Pol Pot bands, or the so-called "Khmer Rouge," numbering several thousand men, with weapons and ammunition--without which they would not be able to conduct hostile terrorist operations against their own people. The foreign press reports that, for the purpose of conferring on the Pol Pot cut-throats a semblance of respectability as a step toward joining with them, Washington won over two Khmer emigrant groups (followers of Sonsan and Sianuk) behind the ruse of a so-called "Coalition Government of Democratic Kampuchea." The advertised decision concerning Pol Pot's withdrawal from the post of commander-in-chief of the "Khmer Rouge" served this purpose. At the same time, the provocative exaggeration of the so-called Kampuchean question continues in the UN.

The Kampuchean Peoples Revolutionary Army, together with units of Vietnamese volunteers, who were in the country at the request of its government, are delivering ever greater tangible strikes on the counter-revolutionary bands. In 1982-1985, part of the Vietnamese volunteers, having completed their international duty, returned to the homeland, which is evidence of the stabilization of the situation in Kampuchea and the strengthening of its defense capabilities.

At the U.S.'s instigation, the Thai Army frequently began to support the bands' criminal acts with artillery fire. The Thai military machine is being built up quickly, and deliveries of armaments and military equipment to it are being increased. The size of its armed forces exceeds 235,000 men. The Pentagon obtained the rights "in case of necessity" to use military sites on Thai territory. In other words, this conflict is also being used by Washington to create the conditions for direct armed intervention in Southeast Asia.

The activities of the imperialists heated up the situation in Central America to an extremely dangerous degree, primarily around Nicaragua, where, in 1979, as a result of a mass movement, led by the Sandanista Front for National Liberation, the completely rotten pro-American Somoza dictatorship was toppled. At the present time, the people of that country, in essence, live under condition of an incessant undeclared war.

Under the aegis of the CIA, several counter-revolutionary groups have been created for the struggle against the peoples' power, the participants of which are called "Contras" in Latin America. The largest groups of them are the so-called "Nicaraguan Democratic Forces (NDS)," and the "Democratic Revolutionary Union (DRS)," who carry out their subversive operations, by intruding on Nicaraguan territory, from Honduras on the north and Costa Rica on the south, respectively. The main body of "Contra" leaders, primarily in the NDS, are former officers of Somoza's national guard--the main support of the overthrown dictator's regime. The total number in the "Contra" band is as many as 15,000 to 18,000 men. As a result of U.S.-inspired terrorist acts in Nicaragua, thousands of people have been killed and there has been material damage to the country in excess of 1.5 billion dollars.

Under the cover of fabrications concerning the "civil war" supposedly taking place in Nicaragua, the U.S. is taking new steps for rendering military, financial and other aid to the counterrevolutionaries. According to foreign press data, the sum earmarked by the U.S. for conducting policies of

interference in the affairs of that sovereign state, has exceeded 100 million dollars. Not long ago, Washington began the distribution of an additional 27 million dollars among the "Contras." Additionally, in the last year alone, the counterrevolutionary groups have received 25 million dollars from private sources in the U.S. and other Western countries.

The militarization of the countries adjacent to Nicaragua is being carried out at a persistent tempo, particularly Honduras, on whose territory, under the guise of conducting exercises, a significant grouping of American forces is located on a practically continuous basis. The size of the Honduran army is being increased, and it is being supplied with modern combat equipment. Costa Rica, where traditionally there have been no regular armed forces, is being pulled more and more into these militaristic preparations, and Washington is striving to impose military functions on the so-called civilian police which exists in that country. The consolidation of a grouping from the eight small eastern Caribbean states is continuing. They are planning to attach it to the militaristic bloc which is being developed in Central America for exerting pressure on Cuba and Nicaragua. All this will increase the tension in the region still more.

At the same time, everything is being done to prevent a peaceful settlement of the crisis in the region, for which Nicaragua is striving persistently. As is well known, the Sandanista government many times has announced its readiness to sign the "act of peace," worked out by the Contadora group as early as September 1984. Right now, with the help of behind-the-scenes machinations they are attempting to introduce into that act such amendments which, in practice, would weaken Nicaragua's capability to defend its independence. Doubt is cast over the very efforts of the Contadora group and also the group of Latin Americans supporting the Contadoras.

Angola is the target of imperialism's uninterrupted subversive acts, racism and internal counterrevolution. That country, after a protracted armed struggle that led to political independence in 1975, has not known a single day of peaceful life throughout virtually all the years which followed.

At first, with the help of separatist forces, imperialist circles managed to provoke a civil war in Angola, and after that to unleash open aggression by the Republic of South Africa (UAR) against the young republic. Through the resolute support of the USSR, Cuba and other socialist countries, the Angola Army dealt crushing blows on the aggressor forces and by March 1976, drove them from the country.

Later on, the imperialists and racists placed their main emphasis on the subversive terrorist activity of the counterrevolutionary groupings, mainly the so-called "National Union for the Complete Independence of Angola" (UNITA), who have been conducting their plundering raids in Angola from Namibian territory occupied by the UAR's racists. These terrorist actions are backed by periodic incursions of South African forces on Angola's territory. The damage from the UAR's armed actions and economic sabotage, inflicted on Angola, is estimated by foreign specialists at ten billion dollars.

While announcing certain aspirations for a "peaceful settlement in South Africa," official Washington, in fact is widening the subversive activities against Angola. The terrorists from the UNITA band are called "Freedom Fighters" in the U.S. Placed for consideration before the American Congress are two bills, the authors of which are seeking "open and direct" delivery of weapons and combat equipment to the cut-throats from UNITA in the sum of 27 million dollars. Aid to the insurgents is also carried out through CIA channels.

For the purpose of exerting influence on Angola, such thoroughly insincere argument as the attempt to "link" the issue of solving the Namibian problem with the absolutely irrelevant question concerning the presence in Angola, at the invitation of its government, of a Cuban military contingent for repulsing external aggression. It is impossible to perceive such an approach as anything more than an attempt to whitewash the operations of the South African racists and the UNITA bands which are supported by them and to galvanize the tension in that region.

The forces of imperialism, racism and the internal counterrevolution are also carrying out similar subversive operations in regard to Mozambique, whose people, in 1975, also achieved political independence as a result of a long armed struggle. The territorial grouping, the so-called "Mozambique National Resistance" (MNS), whose numbers exceed 10,000, and is supported by the intelligence services of the U.S., UAR and a number of other countries, is imperialism's and racism's main weapon in the struggle against that country's people's power. These bands' are equipped primarily with American- and South African-made weapons and military equipment.

Data have appeared in the foreign press concerning the maintenance of direct communications between the so-called MNS band's "high command" and the UAR's military staff. Additionally, for training terrorists, "soldiers of fortune" from the U.S., Israel, Great Britain, Portugal and South Africa are being engaged. Some of these mercenaries have participated in terrorist strikes, the victims of which were innocent non-combatants.

Recently, as a result of operations of the peoples' forces for the liberation of Mozambique and units of Zimbabwe's armed forces, serious blows have been dealt the terrorist bands. However, the tension of the situation in that region is not abating. The South African regime is virtually ignoring the agreement between Mozambique and South Africa, signed in March 1984, in accordance with which the cessation by Pretoria, of any kind of support for the MNS bands, is stipulated. On the contrary, the racists are striving to heat up the situation on the borders with Mozambique.

The UAR's racist regime not only promotes armed provocations against the neighboring independent African states, but also attempts, by force of arms, to retain control over Namibia, which it occupied illegally, and has unleashed an actual war against the indigenous people of South Africa (more than 70 per cent of the whole population). The racists' entire war machine, including both the police and the army, is directed at the suppression of the mass movement against the racist elements, which manifest themselves in a wide variety of forms, including paramilitary ones. The Western powers, especially the U.S.,

in words at times condemn the "extremes" of the racist regime, but in deed, render it wide political, economic and military aid, by which they supercharge the tension in the region still more.

In the struggle against the national-democratic revolution in Ethiopia, which overthrew a despotic regime in September 1974, the U.S. imperialist circles place their main emphasis on the reactionary elements in Somalia and on the support of separatist groupings in Ethiopia itself. In the summer of 1977, it fell prey to aggression from Somalia, which, at the instigation of the U.S. and the reactionary Arab regimes, had attempted to seize the region of Ogaden from it. Through international aid from a number of friendly states, the aggressor's forces were defeated and in March 1978, were driven out of the country.

Subsequently, the U.S. foisted an agreement on Somalia by which, in exchange for deliveries of large batches of weapons, it received the right to use a number of military facilities. The allocation of military bases on the Horn of Africa to the U.S. Rapid Deployment Forces, and also the delivery of American weapons to the Somalian regime sharply exacerbated the situation in that region.

The racist UAR, which supplies weapons to Somalia and assigns its military advisors for training the Somalian Army, is also linked to the subversive activities in the region. Simultaneously with this, the striving is evident to activate in Ethiopia, in every way possible, the activities of the separatist groupings who are receiving support from American imperialism.

It is characteristic that, while speaking about the problem of regional conflicts, the U.S. avoids, by silence, the atrocities being caused by apartheid in South Africa, that country's aggression in regard to its African neighbors, the wars of the American puppets in Central America and Southeast Asia, Israel's brigandage in the Near East and much more. Washington is attempting to put the legitimate rule of states, who are going along the path of national liberation and social progress, on the same plane as counterrevolution.

For many decades the Near East has remained the dangerous hot-bed of tension which is the direct result of Israel's aggressive expansionist policy, which rests upon the direct aid and support of the U.S. During the years of the Zionist state's existence (since 1948), its ruling circles have unleashed several wars against neighboring Arab states. As a result of the Israeli occupiers' expansionist actions, Southern Lebanon, the Golan Heights, which belong to Syria, and the Palestinian lands--the West Bank of the Jordan, the Gaza Strip, and also East Jerusalem--found themselves under their heel. The Palestinian people have been deprived of a homeland and their legitimate rights have been trampled by foreign invaders. The total number of Palestinian refugees exceeds 1.5 million persons.

Such blatant actions of the Israeli imperialist circles is explained by the fact that Tel Aviv conducts its policies of state terrorism with Washington's full blessing and direct support. It is sufficient to say that the U.S. military and economic help to Israel, according to the foreign press, exceeds

50 billion dollars. Precisely by this support, large-scale armed forces have been created in Israel, numbering more than 140,000 men and equipped with the newest American weaponry, which not even some of the NATO countries have at their disposal. The Washington sponsors of Tel Aviv have travelled the road from "benevolent neutrality," during its aggressive actions against the neighboring Arab countries, to direct participation in them, as was the case, for example, during the invasion of Lebanon in 1982.

Having counted on separate deals, Washington, together with its "strategic partner" Israel, stubbornly ignores the UN resolutions for a just settlement of the Near East question which take into account the legitimate interests of all the countries, including the right of the Arab people of Palestine to establish their own independent state.

The U.S. and Israel are attempting to use any grounds to supercharge the situation in the region. One of the most recent examples is the newly unbridled anti-Libyan campaign unleashed in January 1986, which led to a sharp complication of the situation in the Mediterranean. By resorting to diplomatic and political pressure and an economic blockade, and by not stopping at a threat of direct military interference in Libyan internal affairs, the partners in the "strategic alliance" are openly conducting a policy of state terrorism. Acts of a similar nature contain within them a serious danger not only for Libya, but also for all the states of that region.

One should note also that the situation in several regions of the world is complicated by the positions of a number of reactionary regimes dependent on the U.S. In these countries, the Pentagon stations contingents of its military forces, modernizes military bases, and conducts exercises to prepare for aggressive acts directly in the affairs of various regions. Gendarme "Rapid Deployment Forces" have been formed in the U.S. and, using them as the basic component, a Unified Central Command (CENTCOM) encompassing 19 African and Southwestern Asian states in its "zone of responsibility," has been created.

A complex situation is being maintained on the Korean Peninsula where the South Korean regime, despite its declarations about the hope of normalizing the situation, is in fact, building up its dangerous military preparations with the help of the United States. The nearly 700,000 man South Korean army is being equipped with offensive-type weapons and combat equipment at a rapid rate. To this it is necessary to add that more than 40,000 American soldiers and officers are stationed on the country's territory. More than 1,000 units of American nuclear ammunition is stored here. Seoul's military preparations, being inspired and encouraged by Washington, are not conducive to creating in the region an atmosphere of trust and mutual understanding, and they block the realization of those peaceful initiatives which have been put forward by the Democratic People's Republic of Korea.

It is possible to cite other examples of dangerous conflicts which complicate the situation in various regions of the world. There are the Iraq-Iran war which has been going on for more than five years, the Cyprus problem, the situation in Chad and the Southern Sahara, etc. For all the various causes which have given rise to these conflicts, one point is clear--the position which the U.S. and the other NATO countries take on these problems and at

times their direct armed intervention as well, not only does not promote a just settlement of the conflicts, but even leads to their being protracted further.

In December 1984, the UN General Assembly adopted the resolution "On the Intolerable Policy of State Terrorism and Any Actions of States Which is Directed at Undermining the Social-Political Order in Other Sovereign States." It is characteristic that the United States abstained from voting. In fact, this resolution condemns precisely those subversive actions which were raised by Washington to the level of state policy.

The development of events bears witness to the fact that these very same forces of imperialist reaction, which are striving to break up the military-strategic balance between the USSR and the U.S., and [between] the Warsaw Pact and NATO, are initiating persistent efforts for the purpose of exciting regional conflicts, by perceiving them as an additional means for supercharging international tension.

In contrast to the U.S., which persistently shows an imperialist approach to the resolution of regional conflicts and attempts to impose its solution to them by pursuing separate deals at the expense of peoples' interests, the USSR and other fraternal socialist countries exhibit a readiness for active cooperation with all the interested states for the purpose of rapidly settling the existing conflict situations and averting the emergence of new breeding grounds of tension in Asia, Africa, and Latin America. The world is indivisible, and any regional conflict in today's strained situation is fraught with the danger of developing into a large- or even global-scale conflict. The regional conflicts being kindled by the forces of imperialist reaction, representing a gross violation of the principles of international law, present, in the nuclear era, a threat not only to independence, but also the the very existence of the people.

The USSR and the other fraternal socialist countries proceed from the fact that the main condition for a political solution of this or that conflict is the absence of any kind of interference in the internal affairs of other people or states. "The Soviet Union," said M.S. Gorbachev, "is for the recognition of inalienable right of each people to freedom, independence and self determination. It supports the principal that this right is not to be violated by anyone, that there will be no attempt to interfere from without, and that freedom and not tyranny will triumph. We have been and will be on the side of the people, defending their independence. It is our international course."

Soviet servicemen, together with all the people of our country completely support this international position. Under conditions of a complex and tense international situation, they display high vigilance and a continuous readiness to suppress imperialism's intrigues against the USSR, its allies and friends, and to defeat any aggressor.

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FOREIGN MILITARY REVIEW

MARCH/MEETING ENGAGEMENT OF FRG ARMORED DIVISION

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[Article by Col A. Yegorov, Candidate of Military Science, Docent; "The March and Meeting Engagement of the FRG Armored Division"]

[Text] The political-military leadership of the aggressive North Atlantic alliance, in their plans for unleashing war against the Soviet Union and the other socialist states, assigns an important role to the Army of the FRG, which is the principal strike force of NATO's armed forces in the Central European theater. It principally contains tank divisions and brigades equipped with modern combat equipment and having, in Western specialists' opinion, great firepower and rapid maneuverability on the battlefield.

Considering experience from local wars and the possible nature of future wars, Bundeswehr leadership believes that tanks still retain the role of the most important asset during the conduct of military operations in the European theater of war. Therefore in the late 1970s and early 1980s it undertook not only a reorganization of tank divisions and brigades, but also increased their number (divisions from four to six and brigades from 12 to 17) by changing infantry (motorized infantry) divisions and brigades to armored.

As the foreign press reports, modern land combat will be characterized by large spaces, and high force maneuverability. Components of this type of combat will be, as a rule, marches by formations and units conducted with the goal of closing with the enemy and deploying in precombat and combat formations for conducting active offensive operations. This has caused increased attention to be given to march training by units, and their skill in conducting meeting engagements, especially under conditions where nuclear or highly accurate conventional weapons are being employed.

West German military specialists assert that, under modern conditions, all marches in combat zones must absolutely be planned and carried out with consideration being devoted to the threat of enemy attack (air strikes, vertical envelopment and special warfare groups, etc.) regardless of how far they are located from the forward elements. Proceeding from this, the goal of a march, in their opinion, consists of timely and totally combat ready

introduction of forces into an operational area to accomplish a combat mission.

It is reported in the foreign press that the tank division is the Bundeswehr's basic tactical army organization. It includes the commander and staff, headquarters company, two tank and one motorized infantry brigade, combined artillery and air defense regiments, nine separate battalions (reconnaissance, signal, engineer, supply, ordnance, medical, security, and two infantry), two separate companies (radio, radio reconnaissance and electronic warfare, hardened against nuclear effects). Altogether in the division are about 22,000 personnel, 305 LEOPARD-1 and LEOPARD-2 tanks, 160 MARDER IFC's, 72 155-mm howitzers, six 203.2-mm self propelled howitzers, 16 110-mm LARS multiple rocket launchers, 36 120-mm self-propelled mortars, 36 self-propelled JAGUAR-1, and JAGUAR-2 launchers with HOT ATGMs, 130 ATOM MILAN launchers, 36 35-mm GEPARD antiair guns, 10 VO-105M helicopters, 34 LUKS CFV's, about 190 M113 APC's, and more than 4,500 vehicles.

The march, judging by many published items in the Western press, will be conducted by the armored division either independently or as a component of a Corps, as a rule, on organic combat or transport vehicles. This permits it to have a sufficiently rapid movement and to arrive at the designated area in a timely fashion as well as to structure a formation which would ensure accomplishment of combat missions by the units and organizations. It is believed that, in order to maintain secrecy in the advance and to reduce losses from possible enemy attacks, marches must be conducted mostly at night or under conditions of reduced visibility in dispersed (in width and depth) columns along multiple routes. The division march formation will be selected to ensure rapid dispersion of the brigades and battalions in case of the threat of enemy attack and, upon contact, accuracy in maneuver, timely deployment and organized transition to battle.

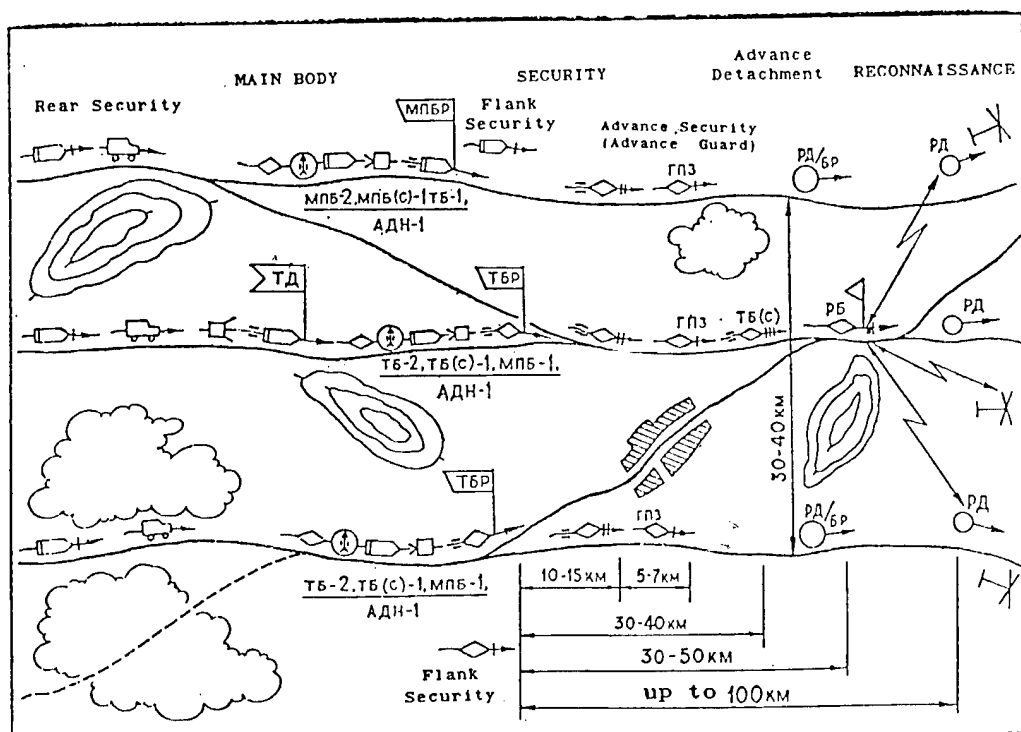
Foreign authors note that a division which must make a march normally designate routes or axes of movement. Multiple routes are designated, as a rule, in case of an advance on a broad front for heightened combat readiness and reduced closure time. One axis of advance may be designated in cases where deployment and commitment of the division from the move is envisioned.

Under modern conditions where, in Bundeswehr leaders' opinion, it is possible that the enemy will use both nuclear and precision conventional weapons, vertical envelopment and tactical aviation during the entire period of movement, the armored division is recommended to designate up to six routes with intervals between routes to prevent two columns from being cut by a single nuclear medium yield weapon. The width of an axis may be 30-40 km. A brigade usually advances on one to four routes or on a 10-15 km axis, and a battalion on one or two routes or a 2-4 km axis.

According to west German manuals, the order of march depends on the situation, commander's concept, terrain and roads, time of day and year, and must provide a possibility for broad maneuver of forces in case of a meeting engagement and during the deployment of the main body. The march is usually made in march columns which are composed of march groups (usually tank and motorized

infantry battalions). The distance between these latter, as a rule, is specified in minutes.

Army training and maneuvers provide evidence that the march order of an armored division, as a rule, includes reconnaissance, an advance detachment, security and the main force (see Figure). It is believed that the original distribution of available forces on march routes has exceptionally great significance in the forthcoming combat actions since upon meeting the enemy and initiation of battle, even slight changes in the march order of the columns of the division are accompanied by great difficulties.



- МПБР - Motorized Infantry Brigade
- ГПЗ - Point Guard
- РД/БР - Brigade Reconnaissance Patrol
- РД - Reconnaissance Patrol
- ТБ(С) - Tank Battalion (S)
- ТБР - Tank Brigade
- ТД - Armored Division
- АДН - Artillery Battalion

Figure. March Formation of an FRG Armored Division (Example)

During preparation and during the march, great attention is paid to the organization and conduct of reconnaissance of the routes, places for halts, maintenance points and areas of concentration. Special significance is given to discovering the enemy main force and the probable nature of his activities during the period when approaching him. To accomplish this task, the division reconnaissance battalion is used, which operates, judging by data from the foreign press, on the entire axis of the division up to 100 km from the main body. Reconnaissance patrols, up to as large as reinforced platoons, are formed from the battalion to conduct reconnaissance. As a rule they do this by observation, concentrating their main strength on the principal routes. Also, reconnaissance organizations from the forces and helicopters are used. In the brigades, reconnaissance is organized from available forces. They also send out reconnaissance patrols, operating at a distance of 30-50 km from the main body. Aerial reconnaissance for the advancing division may be conducted by tactical reconnaissance aircraft to a depth of 150-200 km.

The advance detachment, as West German military specialists assert, may be sent out during the march when a meeting engagement is expected to prevent enemy seizure of favorable terrain, to carry out important crossings over water obstacles or establish timely linking with an airborne assault in the enemy rear. The advance detachment's composition depends on the situation, mission, commander's concept, and may be from a reinforced battalion (normally a tank or motorized infantry team) to a brigade (tank or motorized infantry). The distance from the advanced detachment to the division main body is 30-40km.

The principal security missions for a march are as follows: prevent surprise enemy attack, ensure the uninterrupted movement of the division main body, warn of the appearance of the enemy and the nature of his activities, destroy small enemy groups and create favorable conditions for deployment and joining the battle by the division main body.

Security of each march column on a route is the responsibility of the advance guard, whose primary mission is to prevent surprise enemy attack of the main body and to create for them favorable conditions for organizing deployment and joining the battle. The distance of the advance guard, which is usually sent out with a composition of up to a reinforced tank (motorized infantry) company, from the main body may be 10-15 km, and sometimes even more. To ensure real safety, the advance guard may be put out at a distance of 5-7 km on the march route from the point guard, comprising up to a reinforced platoon. Forward of it, in turn, is the point patrol (tank or IFV) with the mission of warning the point guard of the enemy, and obstacles and barriers encountered on the route.

Security of the flank and rear from surprise attack by enemy ground forces during the march is accomplished by flank and rear security, for which detachments are put out, whose composition and actions are determined by the situation and terrain. They may have a strength of from a reinforced platoon to a reinforced company.

The division main force on the march, in the view of Bundeswehr leaders, should always be ready to deploy, attack the enemy and seize advantageous

terrain (region) in accordance with the mission. In this connection, great attention is devoted to correct placement of divisional units, especially the firing units in the main body column, to ensure rapid deployment upon contact with the enemy and entry into battle.

It is believed that tanks, artillery and antitank weapons should be placed in the column so that they will be able to quickly and jointly enter battle and operate in strict accordance with the commander's decision and make the best use of the situation and terrain.

It has been reported in the foreign military press that the combined artillery regiment (an artillery battalion with a battery of 203.2-mm and two batteries of 155-mm self-propelled howitzers and a division of the PC30 LARS SAM with two batteries of the 110-mm LARS), as a rule, is parcelled out in the division commander's order, and its units make the march in the main body column ready to deploy and occupy advantageous firing positions and to conduct fire support of the brigades during the meeting engagement. The artillery battalions of the brigade (each with three firing batteries of six self-propelled howitzers) are included in the complement of the march groups, following the head of the column in order that they will be able to deploy quickly and, with their fire on the enemy, ensure the success of the main body. Part of the artillery is attached to the advance detachment and advance guard.

On the march, particular attention is given to repulsing surprise attacks by enemy tanks and IFV's. The head of the march columns and open flanks of the force are considered the most vulnerable during the march. For their fire support, one part of the tank destroyer companies of two tank brigades (each company has three platoons of four self-propelled JAGUAR-2's with TOWs) and the motorized infantry brigade (three platoons of four self-propelled JAGUAR-1s with HOT ATGMs) is considered appropriate to attach to the head march groups and another to the vanguard and division advanced security.

The West German leaders suggest that it is appropriate to place a division air defense artillery regiment (six batteries of six 35-mm GEPARD antiair guns) along the march route. It is believed that one battery can cover a 15-km long section of the route (intervals between guns is about 2 km). According to Bundeswehr specialists' assertions, the best means of covering the brigades and battalions on the march with air defense guns is to disperse them along the advance column in readiness to open fire from a short halt. For combat with low-flying targets, 20-mm cannons mounted on MARDER IFV's, 12.7-mm machine guns on M113 APCs, 7.62-mm machine guns on tanks, and other weapons are also used. The force must be covered especially reliably from attacks by enemy air in rest areas, during short halts, during crossings, when traversing defiles, bridges, and other dangerous areas. For this not only the organic divisional weapons are used, but also corps air defense assets.

Organizations from the signal battalion, as a rule, are placed throughout the moving column. However radio communications on the march is absolutely forbidden. Command and communications on the move are accomplished with the assistance of wire signal troops with the march and stationary wire communications of territorial and transportation organizations. Additionally,

for sending orders and reporting messengers on motorcycles, cars or helicopters can be used.

Engineer organizations should be placed along the march column of the main body and in the advance detachment and security. It is given missions of reconnoitering routes, rapid removal of obstacles and barriers along the route, installation of crossings over water obstacles, and engineering support of forces during transition to battle, and others.

Tank division trains form a separate column and follow the division main body or one included in the corps units.

The remaining division combat and service support units and organizations, according to Bundeswehr manuals, are placed throughout the march column such that during movement they can rapidly render necessary assistance and support to division combat units in regulating movement, medical support, supply evacuating unrepairable vehicles, repairing equipment and transport vehicles which have fallen out, and other missions.

According to indications appearing in the foreign press, the average length of a day's move by a Bundeswehr tank division may reach 200 km. Rates of movement have been designated for equipment. These are on a road with good trafficability, for wheeled vehicles 40-50 km/hr (day) and 30-40 km/hr (night), for tanks and tracked vehicles 25-35 km/hr and 15-25 km/hr, for combined columns 40 and 30 km/hr. The division rate of march (average rate for the force from the line of departure to the end or line deployment), in military specialists' opinion, may be 24 km/hr.

During a march, it is recommended that the following intervals are maintained: between vehicles 50-100 m, companies (batteries) 500-100 m, and march groups of battalion size 3-5 km. Depending on the number of vehicles in units and the intervals established, the length of a march group column of battalion size may be 8-12 km, brigades on a single route 50-80 km, on two routes 25-40 km, on three 15-25 km, and a tank division on two routes 110-120 km, on three 60-70 km.

Western military specialists note that for repair and maintenance checks on the march and to rest drivers, breaks (halts) of 20-30 minutes will occur after every 2 hours of movement, and sometimes even longer. Depending on the situation, the assigned mission and the overall length of the march after 6-7 hours a long halt, of not less than 2 hours, may be made for resting personnel and vehicle maintenance. Stopping locations are selected, with consideration of the concealment characteristics of the locale, somewhat off the principal route.

Judging by materials in the foreign press, a tank division's march will have several peculiarities during the period of operational deployment of NATO armed forces in the transition of the armed forces from peacetime to war. In particular, traffic regulation by territorial forces will be conducted in support of the forces. These will include a movement route commander and territorial force battalions of military police. Movement regulating posts will be deployed on the march routes by these forces, which will significantly

increase the division's potential for timely advance to the designated operational area. Experience from tank and motorized infantry division training shows that commanders at all levels are strictly guided by general principles of advancing forces under combat conditions during planning and conducting of marches.

According to Bundeswehr manuals, the tank division on a march should be constantly ready for a meeting engagement.

A meeting engagement, as emphasized in the Western press, is the form of combat in which opposing sides accomplish their mission to defeat the enemy by offense. In NATO military specialists' view, in modern warfare, especially at the start, when the forces have great striking power and mobility, meeting engagements can occur relatively often and will become basically a continuation of the advance of formations and units which are closing with the enemy. A meeting engagement may also occur during a movement to repel a counterattack of the enemy reserves and during a counterattack on his group of forces which have penetrated the defense and are exploiting success. It is noted that it is normally characterized by high maneuverability and short duration of combat, lack of clarity, rapidly changing situation, and an absence of necessary enemy information. It is believed that success in battle is achieved principally by a rapid assessment of the situation and rapid issuing of orders to brigades and battalions, anticipation of the enemy and deployment, seizing and maintaining the initiative and a number of other factors. One of the most important conditions of success in battle is anticipating the enemy in preparing for conducting a meeting engagement. This depends on a skillful order of march, rapid deployment into prebattle and battle formations.

According to West German manuals, a meeting engagement begins with an exchange of fires between the opponents with the goal of inflicting maximum damage to personnel and combat equipment, to support the advance and create favorable conditions for the force. To seize and hold tactically favorable terrain until the arrival of the advance detachment and advance guard, tactical airborne or airmobile assaults subunits (usually a motorized infantry company or battalion).

The division reconnaissance elements are the first to come into contact with the enemy. By their actions they discover the enemy main force, the probable nature of his actions, area of concentration of his principal strength, etc. It is considered desirable in approaching the enemy to increase the strength of the reconnaissance in order to reveal enemy intentions.

As foreign military experts note, the advance detachments elements will enter still further into the battle, inflicting attacks on the enemy force to achieve maximum destruction and prevent his maneuver to gain favorable terrain until the arrival of the main body, and so forth. The advance detachments combat actions are supported by the brigade advance guard which is approaching, to create favorable conditions for deploying the armored division main body. The advance guard may spend up to 30 minutes in deployment and entry into battle. Their combat formation normally will be a single echelon.

The advance detachment and advance guard battle will be supported by all fire support which, at the moment, can be brought into fulfillment of the mission. When the enemy has preceded them in deployment and is conducting an attack, they should, as their manuals assert, inflict on the enemy substantial losses and, by their decisive actions, contain his activity and ensure favorable conditions for deploying the division main body. If an unfavorable situation develops, they may quickly go on the defense, conduct a delaying action or a retrograde, resisting the enemy on good natural terrain features, in order to gain time and preserve strength and freedom of maneuver.

The entry into battle by the division main body, judging by reports in the Western press, should be accomplished in a short period to deny the enemy the possibility of deploying first. Depending on the local trafficability, the situation, the mission, the commander's concept, enemy pressure and the march formation, deployment of brigades moving on a single route is expected to begin at a distance of 10-15 km in the battalion columns in companies at 5-8 km, in platoons at 2-3 km from the attack position.

In West German specialists' opinion, armored division main bodies may attack either directly from the march by units (according to their arrival) or after closure, a short halt, and simultaneous deployment of all division forces. In the first instance the division attacks from the move with its first units without a preparatory halt about 40-50 minutes after the advance guard battle begins. In this case the division first echelon will contain as many battalions as there are brigade columns (up to three tank or motorized infantry battalions). The remaining division forces attack according to their arrival in the battle area.

Attacking piecemeal is considered appropriate when meeting an inferior or equal-strength enemy, as well as in those cases where superiority has been obtained through fires. This sequential attack by the main body is most characteristic in a tank division meeting engagement since, in this case, the division commander wins time, deploys before the enemy, and maintains control of the initiative.

In the second case, when the division is opposed by a superior enemy, it should attack together after a short halt for deployment into battle formation and preparatory fires. The short halt is essential for deployment of the approaching units into combat formations, coordination of actions, command and control, and getting the artillery into firing positions. Based on a number of training exercises, the leading brigades of the division main body can attack in 2-3 hours from the initiation of the advance guard battle.

Another variation is also possible when the division faces an enemy superior in tanks and conducts a temporary defense to inflict the maximum possible casualties on the enemy, create favorable conditions and then go over to the offensive to complete the destruction of the opposing enemy formations.

As emphasized in Bundeswehr regulations, the tank division formation in a simultaneous attack is envisioned as having the main force structured in two echelons. The first echelon normally is given two brigades and the second, one. It is believed that the second echelon should include more tank elements

and be ready to reinforce the first echelon with a goal of exploiting the success of the main attack. A single echelon division formation is an exception for use on a wide front when each brigade is moving on its own route.

A number of exercises show that, at the initiation of the advance guard battle and approach of the leading units of the division main body, the principal artillery units occupy firing positions and fire mainly on detected nuclear delivery weapons, command posts, artillery, antitank weapons, leading enemy battalions and the following columns.

In Bundeswehr commanders' view, the principal forms of maneuver for a meeting engagement are the turning movement and envelopment, and, in exceptional circumstances, a frontal attack may be employed (when the enemy deploys before the main body). Selecting one or another form of maneuver is determined based on the division's mission, terrain, and the enemy formation and activities. The width of the division, brigade and battalion zones, and depth of objectives will be the same in a meeting engagement as in an attack.

After the armored division main body is introduced into the battle in a meeting engagement, that type of battle is over and, depending on the situation, the force transitions to another form of combat (attack, defense, retrograde).

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FOREIGN MILITARY REVIEW

U.S. ARMY TACTICAL LINK SPACE COMMUNICATIONS SYSTEMS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 3, Mar 86 (Signed to press 4 Mar 86) pp 25-31

[Article by Col A. Chizhov, Candidate of Technical Sciences; "U.S. Army Tactical Link Space Communications Systems"]

[Text] In the U.S. work on using space for military purposes, including supplying tactical link communications for the ground forces, has been underway ever since space was opened up. American specialists have developed several generations of space communications earth stations and artificial earth satellites (AES) with space retransmitter stations on board.

The first experiments in providing space communications to the tactical control link were conducted during the latter half of the 1960s using LES-5 and -6 (Lincoln Experimental Satellite) satellites and the EASTT (Experimental Army Satellite Tactical Terminal)-type space communications stations. Then the TACSAT communications satellite was built, along with a series of test space communications stations. Based on the results of the tests and trial use of this equipment, there subsequently followed the development of the functional MARISAT, FLEETSAT and LISAT communications satellites and a series of space communications stations for all control links of the U.S. Army, Air Force and Navy forces operating within a theater of military operations.

Based on the experience in using test and in-service stations, the U.S. Army command believes that space communications will, to a significant degree, satisfy the requirements of modern combat and may be used as links from the battalion to the army corps, inclusively. By using these assets, communications are practically assured for ranges up to 12,000 km, regardless of weather conditions, the time of year or day, the nature of the terrain and environmental factors. To use them, one does not have to select and prepare deployment areas, since they can be rebased quickly in any region and communications can be established with users located at various distances. When ultra-shortwave wavelengths are used in space communications, station antennas are kept out of sight since the communications satellite is located above the horizon. Furthermore, the building and servicing of space radio lines have been simplified and the number of service personnel has been reduced in comparison to radio relay and tropospheric communications lines, since there are no intermediate servicing stations for space radio lines. The

channels created with space communications can interface with and be used within the framework of the ATTACS (Army Area Tactical Communication System).

At the present time, basically second and third generation mobile space communications stations are used to provide satellite communications to the U.S. ground forces (See table). Their basic feature is their use of specialized devices which allow multistation access with frequency response, timing, and coded channel splitting. In this way, the coding of information and user address are accomplished with a multi-position frequency code using a frequency-time matrix. This results in an output signal that is like noise. Thus foreign specialists point out that the use of such signals, along with the simultaneous operation of many stations on a common radio channel and increased protection against narrow band jamming, allows one to conceal station operations, rapid mutual synchronization, and, at the same time, relatively simple communications organization procedures.

Two types of special devices (TATS - modems) to satisfy the requirements for organizing communications with moving objects have been developed and introduced into tactical space communications networks for existing stations that work with coded channel splitting. They are calculated to work at two information transmission rates - 75 and 2,400 bits/sec. The 75-bit/sec device is intended to operate within a space communications network that has a large number of stations that operate on the same mode. Such networks are created to increase the efficiency and quality of information exchange for users of the tactical control link by using a base control station and a special set of commands. The second type of modem is intended to exchange information in a multi-channel mode among the most important users.

The use of multi-station access using the "radio-automated telephone exchange" principle is considered promising. Its characteristic feature is an on-board radio relay device that assigns a free radio channel upon request (demand) at the command space communications station. Communications are organized by the control station operator, to whom orders are sent. When a free channel is available, the moment the operator receives a request, he transmits, using a computer, all the necessary data to establish communications and to maintain control over its use. Otherwise the demand is stored in the memory and is queued for processing. In American specialists' opinion, the realization of this principle allows one to make more effective use of radio relay capacity and to improve the flexibility and structural reliability of the space communications network in comparison to networks that have fixed channels where each station has to transmit on a separate radio channel.

Existing second generation receiver-transmitter stations work in a telephone mode using analog signals and frequency modulation. A mode such as this is envisioned to interface with old-type stations, however, it is recommended that it be used in exceptional cases because, in so doing, the capacity of the activated satellite radio relay device is sharply reduced.

Nearly all tactical control link stations receive indication and warning signals in a frequency keying mode. This is done on a conferencing radio channel. Warning commences by transmitting a 40 second-long synchronous sequence. Then the signals itself is repeated ten times, in the form of a

Primary Tactical and Technical Specifications of Ground-Based Satellite Communications Systems

Model Name	Transmitter Power, W	Antenna Type (Diameter, M)	Transmission Capability (Channels)	Signal Type or Operating Mode	Transport Base (Weight, kg)
TEST STATIONS					
AN/TPP-300	Receiver	Parabolic (0.3)	1 TG or 1 CO	БП	(28,6)
AN/TPP-32	Ditto	Whip (0.28)	1 TG or 1 CO	БП	(15)
AN/TSC-79	3-10	Parabolic (0.91)	1 TФ and 1 CO	ЧМ, СВД	(83)
AN/TRC-156	2 or 20	Abbreviated Inverse Emission (2.13)	1 TФ (1 СВД) and 1 CO	ЧМ, СВД	(54)
AN/MSC-57	3-100	Parabolic (0.91)	1 TФ (1 ПД) and 1 CO	ЧМ, СВД, ЗС, БП	¼-t Vehicle Trailer
AN/MSC-58	1-100	Abbreviated Inverse Emission (2.13)	4 TФ (1 ПД) and 1 CO	ЧМ, ШПС, ЗС	Ditto
AN/TSC-80	1.5-500	Parabolic (1.2)	1 TФ (12 ПД) and 1 CO	ЧМ, ШПС, СВД, ЗС	1¼-t Vehicle Trailer
AN/TRC-157	1-1000	Abbreviated Inverse Emission (2.13)	12 TФ (1 ПД) and 1 CO	ЧМ, ШПС, ЗС	Container Trailer (780)

STATIONS IN SERVICE

AN/PSC-1	35	Spiral	1 Telephone or 300 baud	ЦС, ЗС, СВД	(16,8)
AN/MSC-59	100	Parabolic (2.4)	Up to 12 Telephones or 16 kbaud	ЦС, ЗС	Trailer (680)
AN/TSC-85 (V) 1	Klystron 500	Ditto	Up to 96 Telephones or 16 kbaud	ТФ, ПД, БП	Container (1130)
AN/TSC-85 (V) 2	Klystron 500	"	4 X 24 Telephones (4 X 48 kbaud)	ТФ, ПД, БП	Container (1500)
AN/TSC-86	Klystron 1000	"	96 Telephones or 16 kbaud	ТФ, ПД, БП	Container (2500)
AN/TSC-92	100	"	6, 12 Telephones or 16 kbaud	ЦС, ЗС, БП	2.5-t Vehicle (3285)
AN/TSC-93	500	"	24 Telephones or 384 kbaud	ТФ, ПД, БП	Container (1250)
AN/TSC-94	500	"	6 or 12 Telephones	ТФ, ПД, БП	Container (1250)

ТФ - Telephone; TG - Telegraph; ПД - Data Transmission;
 CO - Warning Signal; СВД - Superhigh Speed; ЧМ - Frequency Modulation; ЦС - Дигитал Цоммуниатионс; ЗС - Encrypted Communications; БП - Teletype; ВС - Vocoder Communications; ШПС - Wide-Band Communications; ФТ - Phased Telegraphy

12-bit coded combination. After demodulation and decoding, the signal is displayed on decade-counting tubes as two digits. The method selected for coding allows one to form fifteen distinct coded combinations. Break displays are produced by the receiver's logic circuits. For the receipt and display of the signal, it is necessary that no less than three consecutive repetitions are decoded identically out of the ten being transmitted. Only in this case is the signal displayed. The time needed to deploy a station referred to above does not take more than 20 minutes, and requires from 2-5 personnel.

The foreign press also notes, that some tactical control link space stations operate at super high speeds using an auxiliary device that functions on the phased telegraphy principle. It is used primarily to transmit discrete information at high speed. In order to multiplex the radio channel temporarily, an auxiliary assembly is used.

The AN/TSC-86 station, which has been mass-produced since 1982, is intended for equipping U.S. Army formations and large formations. It supplies intrazone main line telephone communications, data transmission and teletype. The range of operating frequencies is from 7,250 to 8,400 MHz. It is intended to work in a network consisting of five similar stations using a scrambler.

The station equipment fits in a standard S-280 container that goes either on a truck bed or a wheeled vehicle chassis. It contains a transmitter assembled on a klystron with an adjustable output capacity up to 1,000 watts, a receiver with amplifier, a multiplexing device and a scrambler. The station is equipped with two kinds of antennas with automatic guidance to one of the communications satellites located in stationary orbit. The first antenna (with a reflector diameter of 2.4 m) can be set up either on the ground or on a trailer roof (for operation while moving). The second type antenna (6 m in diameter), with a larger amplification coefficient, is used for fixed stations. Retuning the receiver-transmitter frequency is done in a steps. The basic mode for operating the station is multistation access with frequency modulation and frequency division multiplexing. The power supply (a diesel generator) is mounted on a single axle trailer. The output power is 30 kW. It takes no more than 30 minutes to deploy the station.

The family of light mobile satellite communications stations: AN/TSC-85, AN/TSC-93, and the AN/TSC-94, like the preceding model, are made by RCA for use in ground force units, even though the last item was developed to meet U.S. Air Force requirements. The stations provide telephone communications, data transmissions and teletype. They work in the centimeter wave range (frequencies of 7,250-8,400 MHz). The station equipment with spare components fit in a standard S-250 container that is made so it can be mounted on a vehicle body or transported by helicopter. The transmitter has a variable output of up to 500 watts.

One feature of these stations is their modular design principle. The station modules are identical with the exception of the output stages of the transmitters' capacity. All stations use a parabolic antenna (2.4 m in diameter), and run on 50-60 cycle 115/230 AC voltage.

Externally the stations look the same. However, they differ in the amount of spare equipment they carry and the make-up of the system's multiplexing and multi-station access, which determines several features in their mode of operation and their use in supplying communications under specific conditions of the situation. The AN/TSC-85 station has two modifications. One of them, the AB/TSC-85(V)2 has three auxiliary modems and can work in the nodal mode with four AN/TSC-85(V)1 stations or four AN/TSC-93 (a satellite communications network for an army corps with four divisions performing basic combat missions along the main axis (Fig. 2). The Army corps nodal station works by transmitting over 96 telephone channels (24 channels for each division user station). The formation of a single information flow (unifying signals into a single digital sequence) at the nodal station is done with a TSSP (Tactical Satellite Signal Processor) computer.

This grouped flow is transmitted on a working frequency in the form of a phased-manipulated signal to the user stations who demodulate the signal and, using their computers, separate out the group intended for them from the 24 channels. In the opposite direction a structurally analogous group of channels is transmitted by each user station on a working frequency assigned to it.

The AN/TSC-93 user station can provide duplex communications over 6, 12, or 24 telephone channels using a standard issue code-pulse modulation device. The possibility of transmitting discrete information along a telephone channel at a speed of 16 (32) kbit/sec and of ganging channels and group flows with a standard scrambling device located in an appropriate communications center is being examined. The AN/TSC-94 station is, from a design standpoint, analogous to the preceding model. It works on 6 or 12 telephone channels that are capable of rapid atmospheric transmission.

The light, transportable AN/MS-59 station is used to provide telephone communications, data transmission and teletype within the ground forces' tactical control link. It allows one to conduct simultaneous conversations over 6 or 12 duplex telephone channels (the width of the spectrum for each is up to 8 kHz). The long-distance reception of discrete information at a speed of 16 kbit/sec is envisioned. To permit maximum information flow, information is transmitted at a speed of 48 kbits/sec, but in cases where jamming (suppression) is present, it is lowered to 16 kbit/sec and switches into single-channel telephone operation.

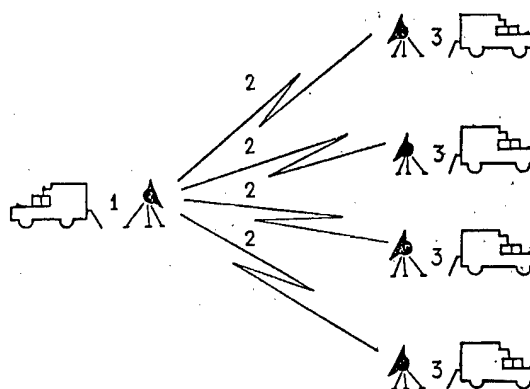


Figure 2. Operating Principles of an Army Corps Satellite Communications Network.

1. AN/TSC-85(V)2 Nodal Station.
2. Radio Lines Using Satellite Communications.
3. AN/TSC(V)1 and AN/TSC-93 User Stations.

The station equipment (weight 680 kg) is mounted on a trailer. Its components consists of a transceiver, a TD660 multiplexer to provide channel multiplexing, a converter to convert the signal to digital form, a CV-1548/G, an echo suppresor and spare modules. The electric power comes from a standard AC 115/230 volt (50-60 cycle) generator.

The mobile AB/TSQ-118 is designed to organize the operation of operational and tactical control link space communications in networks of stations. One equipment set consists of an AN/TSC-85 station set, an automated computer-controlled spectrum analyzer, as well as a device to control and remotely adjust the station parameters within a given network. At the same time, the distribution of working frequencies for space communication stations that are part of the network is provided. Also, an optimal output power is established for each station when operating within a multi-station access network for a satellite with frequency division multiplexing. Furthermore, output data are transmitted in order to designate targets and automatically aim all stations' antennas at the assigned satellite and track it throughout the communication period.

The AN/TS-118 station is attached to the technical control point of the communications center's CESE (Communication Equipment Support Element), and is integrated with the equipment with the general-purpose communications network's command and control center's CSCE (Communication System Control Element). Teletype, with scrambled transmitted information, is employed using a TSEC/KG-27 device when using satellite communications. The station and antenna can be packed into containers and transported by air. It takes 20 minutes to redeploy it to a new site.

The portable AN/PSC-1 was developed in 1977, by the firm Cincinatti. It provides long-range communications via satellite relays and makes it possible to interact directly with many kinds of ground and on-board (plane and helicopter) ultra-shortwave radio stations.

The station set contains a transceiver, an antenna and a special unit. From a design standpoint, it comes in the form of two units outfitted so they can be carried by a single operator. The Station antenna is built like a rectangular net reflector with a spiral radiator. When not set up, it is packed away in a case that attaches to the operator's belt strap. The antenna, which weights 2.5 kg, is mounted on a light tripod and can be quickly deployed in the necessary direction. For line-of-sight communications with regular radio stations in the 225-400 MHz range, the AN/PSC-1 uses a whip antenna.

The special unit (weight, 1 kg.) includes a minicomputer, an "analog-to-digital-to-analog" converter, and a small-sized display unit. The computer provides automatic data accumulation while receiving, storage of necessary data, and automated transmission of messages already entered into its memory. Speech signals are turned into digital form and vice versa using delta modulation and demodulation. Signals are transmitted and received at high speed, making radio interception and jamming difficult. Hooking the station up to a standard voice scrambling device is also being looked into. There are sound and light displays to control the system's operations. The station uses a silver-zinc storage battery (weight 6.1 kg) with an output of 24 volts, as

its power source, providing uninterrupted operations for a period of 12 hours with a reception-transmission time ratio of 9:1.

The AN/PSC-1 station provides communications via the FLEETSAT and MARISAT satellites. There are 7,000 fixed frequencies for telephone use (and 35,000 for data transmission). The weight of the transceiver is 5.2 kg, and the dimensions are 18 x 30 x 8 cm. The time it takes to deploy the device, set up and orient the antenna, as well as establish communications is no more than four minutes.

Raytheon is developing a station which is expected to provide satellite communications in millimeter wave lengths. At the present time, it is undergoing comprehensive testing in conjunction with the experimental LES-8

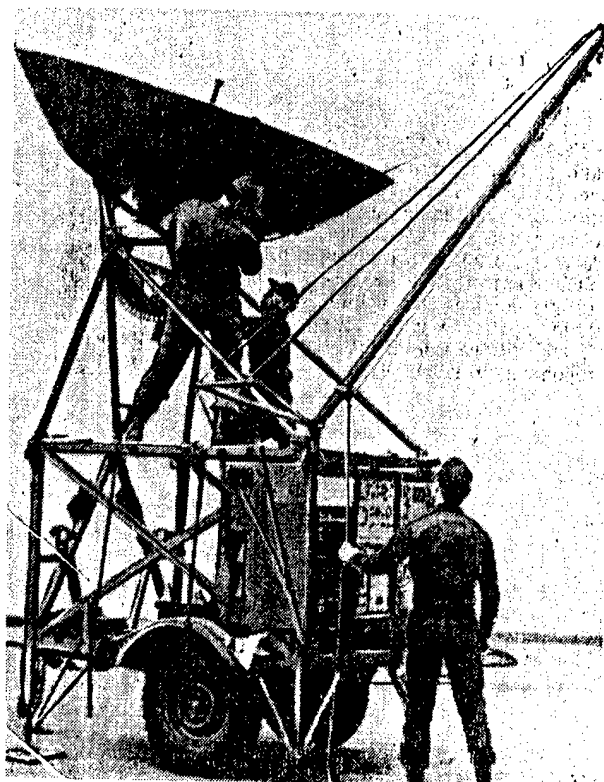


Fig. 3 Mobile AN/MS-59
Station

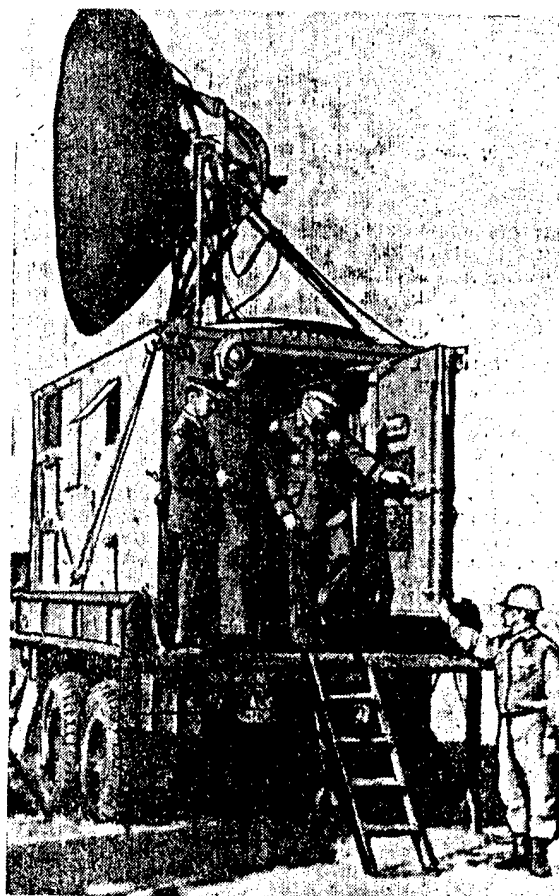


Fig. 4 Space Communications Network
Control Station AN/TSQ-118

and LES-9 communications satellites. Its components consists of a multi-functional receiver, a multi-cascade transmitter and an antenna-feeder section.

The receiver includes a preamplifier, an amplifier-converter section, demodulators, and a correcting circuit to tune in to carrier frequencies by taking the Doppler effect into account. The preamplifier has two uncooled parametrical amplifiers designed to receive the frequencies of 37.98, 38.04, 36.84 and 36.9 GHz.

The amplifier-converter provides reception of the intermediate frequencies of 870, 700, 70 and 5 MHz (the first is used in the circuit for the doppler correction of the frequency, the second and third are put in the external demodulators, and the fourth goes into the internal demodulator to separate out the signal used in the antenna's automatic satellite tracking system.

The receiver's external modulators coherently detect a phase-manipulated signal and separate out useful information received in digital form at speeds of 0.2, 10, 20, 100, or 200 kbits/sec.

The doppler correction circuit provides automatic frequency tuning for the signal being received from the satellite.

The station transmitter includes a modulator, a master oscillator, a frequency converter and two power amplifiers. The modulator converts digital signals (data) from a teletype or vocoder into a noise-like signal which modulates the intermediate frequency of 70 MHz. The master oscillator, which receives the 70 MHz frequency signals from the modulator and 20 MHz from the receiver, generates its own frequency, which, aided by the converter and its heterodyne, forms frequencies of 36.7876 (to operate via the LES-8 satellite) and 38.0924 GHz (to operate via the LES-9 space communications satellite).

The feeder section provides for decoupling of the receiver and transmitter when working off a common antenna. Its basic element is a polarized diplexer which is connected to the antenna by a round waveguide (with an inside diameter of 8.33 mm) and which has two rectangular waveguide leads (for signals with right and left rotational polarization).

As noted in the foreign press, space communication systems, both existing and those under development, which are intended for use as a U.S. Army tactical control link, are characterized by quite high operational reliability, including conditions of nuclear weapons and means employment, in electronic warfare, where there are rapid drops in temperature, a great deal of moisture and dust, and a lot of shock load and vibration. These stations have modular design, a maximized level of unification, and built-in operational control devices, all of which facilitate the training of service personnel, improve the quality of their operation, and allow a mutual exchange of station crews and individual operators.

Based on Pentagon specialists' evaluation, the appearance of multichannel, light, mobile means of space communications in the tactical link that permit operation on assigned channels within narrow operating conditions and in communications networks with the coded multiplexing of noise-like signals and

which have high viability and resistance to jamming, makes it possible, in carrying out combat operations, to significantly improve the quality of unit and subunit control in the ground forces, particularly those separated from the main forces.

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FOREIGN MILITARY REVIEW

THE AUSTRALIAN AIR FORCE

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 3, Mar 86 (Signed to press 4 Mar 86) pp 33-38

[Article by Col. A. Nikolayev; "The Australian Air Force"]

[Text] In carrying out a domestic and foreign policy and in solving world and regional problems, Australia's leadership adheres to a pro-American, anti-socialist policy. Australia is an active member of the aggressive ANZUS bloc (which also includes the U.S. and New Zealand), and of the five-country regional military group ANZUK (Australia, New Zealand, Great Britain, Malaysia and Singapore). According to foreign press reports, more than 15 various U.S. military installations are located on its territory. In accordance with a 1981 agreement, the right was granted to the American command to deploy B-52 strategic bombers at Darwin Air Base. Warships belonging to the United States regularly call at Australia's bases and ports. Joint exercises within the limits of the ANZUS bloc are conducted on a planned basis, and the purchases of primarily American weapons and combat equipment is carried out.

In striving to avoid a schism within ANZUS, Australia, under pressure from the U.S., is trying to persuade the New Zealand government to renounce its decision not to allow combat ships with onboard nuclear weapons into the country's ports. Australia directly participates in the operations of the American Armed Forces in the Indian Ocean, for which it assigns its ships and aircraft to patrol its waters. The orientation toward the U.S. in conducting a military policy and developing the armed forces, and the support of all Washington's military-political measures in the Asian-Pacific region compels Australia's Labour government to continuously increase the expenditures for defense and to build-up its armed forces. Also according to Western military experts' opinion, their general number (approximately 72,500 men) significantly exceeds national requirements. One of the important branches of the country's armed forces is the Air Force, which is determined by Australia's strategic position, its role and place in the U.S.'s general military strategy. According to foreign specialists' testimony, currently the Australian Air Force is adequately prepared to conduct combat operations and occupies a leading place among the air forces of the Southeast Asian and the Pacific Ocean countries.

The following missions are entrusted to the Australian Air Force in accordance with the main tenets in the combat employment of aviation: to protect administrative and industrial centers and military targets from air strikes; to provide direct air support to ground troops and the navy; to patrol the adjacent Pacific and Indian Ocean waters; to conduct aerial reconnaissance; and to transport personnel and equipment.

The Australian Air Force's organization and combat make-up, the combat training and development prospects are elucidated below, based on information published in the foreign press.

THE ORGANIZATION AND COMBAT MAKE-UP. Australia's Air Force was created as an independent branch of the armed forces in 1921. Presently, it includes more than 100 combat aircraft and more than 260 auxiliary aviation aircraft and helicopters. The number of personnel is approximately 23,000 men.

Its leadership is entrusted to a chief of staff, who is simultaneously the Air Force commander and is directly subordinated to the defense chief of staff (the Armed Forces commander). The Air Force commander carries out the command and control of Air Force units and subunits through a staff consisting of several directorates and departments, and two commands: the operational command (OC) and the rear command (RC).

The **OPERATIONAL COMMAND** (the headquarters is located at Glenbrook) is set up to ensure execution of the missions entrusted to the Air Force: operational and combat training and maintenance, and to maintain them at a high degree of combat readiness. In accordance with foreign press reports, the operational command (OC) includes several multi-purpose air wings. Each wing in turn includes from two to six air squadrons, which comprise the basis of the combat force. According to foreign press evidence, there are 18 air squadrons in the Australian Air Force, including two fighter-bomber squadrons (the 1st and the 6th), three PVO fighter squadrons (the 3rd, 75th and 77th), one reconnaissance squadron (the 2nd), two shore-based patrol squadrons (the 10th and 11th), six transport squadrons (the 33rd, 34th, 35th, 36th, 37th, and 38th), three helicopter squadrons (the 5th, 9th and 12th), one combat training squadron, and also several training subunits. Each of these executes the missions inherent to the given arm of the Air Force. However, the 34th Air Transport Squadron carries out specific functions. It transports the high-level members of government and foreign delegations.

The Air Force's inventory consists of F-111 tactical fighters with various modifications (A, C, and the RF-111C reconnaissance variant), MIRAGE-3 fighter-interceptors, and the P-3B, and P-3C ORION shore-based patrol aircraft. Twenty four C-130E and H aircraft, and also 15 DHC-4 CARIBOU aircraft comprise the basis of military-transport aviation. The inventory of the helicopter squadrons include: UH-1B and H IROQUOIS, AS-350B and Ch-47 CHINOOK. MIRAGE-3D and MB-326H are used as combat-training aircraft, and CT-4A, MB-326H and HS-748 are used as exercise-trainers (more detailed information on the Australian Air Force's make-up is presented in the table).

Combat Composition of the Australian Air Force

SQUADRONS			NUMBER AND TYPE AIRCRAFT (HELICOPTERS)
TYPE	NUMBER	NUMBER (Airbase)	
COMBAT AVIATION			
Figher-bomber	2	1st (Amberley)	10 F-111C
		6th (Amberley)	6 F-111C, 4 F-111A
Fighter	3	3rd (Butterworth)	20 MIRAGE-3
		75th (Darwin)	18 MIRAGE-3
		77th (Williamtown)	19 MIRAGE-3
Reconnaissance	1	2nd (Amberley)	4 RF-111C
Patrol	2	10th (Edinburg)	10 P-3C ORION
		11th (Edinburg)	8 P-3B and 2 P-3C ORION
AUXILIARY AVIATION			
Transport	6	33rd (Richmond)	4 Boeing 707
		34th (Fairbairn)	3 MISTER-20, 2 VAS 111, 3 HS-748
		35th (Townsville)	7 DNS-4 CARIBOU and 3 UH-1B IROQUOIS
		36th (Richmond)	12 C-130H HERCULES
		37th (Richmond)	12 C-130E HERCULES
		38th (Richmond)	8 DNS-4 CARIBOU
Helicopters	3	5th (Fairbairn)	15 UH-1B and H IROQUOIS, 16 AS-350B
		9th (Amberley)	16 UH-1B IROQUOIS
		12th (Amberley)	8 CH-47 CHINOOK
Combat Trainers	1	--	16 MIRAGE-3D, 10 MB-326H
Trainers		--	48 CT-4A, 65 MB-326H, 7 HS-748, 6 CA -25

The REAR COMMAND (headquarters at Melbourne) deals with issues concerning the material-technical support of units and subunits; the technical servicing and repair of aviation equipment and armament; and the training of pilot and technical cadres. It conducts scientific research and development in the field of aviation

BASING. According to foreign press reports, Australia, except for its central and northeast regions, has a widely developed airfield network at its disposal. It was developed with the direct help of the U.S. and Great Britain in accordance with the jointly worked out plans to equip the territory operationally. During the construction of the air bases, as with other military installations, their possible uses both by the national Air Force and the air forces of other countries, above all the United States, in connection with their expanding military presence in the Indian Ocean region, were considered. For these purposes, the most important of them are continuously being modernized and equipped with modern radio and lighting equipment, allowing the flights of all classes and types of aircraft to be carried out day and night in any weather conditions.

The main airbases with a runway length of 2,500 m and more, at which the main group of Australia's Air Force is based, are Amberley, Williamtown, Fairbairn, East Sale, Edinburgh, Pearce, Darwin and Townsville. In addition, in accordance with a "Five-Country Agreement on the Defense of Malaysia and Singapore," the Australian Air Force uses Butterworth Air Base on the territory of Malaysia. The 3rd Fighter Squadron is permanently deployed there. The locations of the main headquarters and the Australian Air Force's airbases are shown in Fig. 2.

The COMBAT TRAINING of Air Force units and subunits is organized along the lines of the military policy and the armed forces development and is directed at further increasing Air Force combat capability and combat readiness. It is carried out by daily combat training, and various exercises and maneuvers, conducted according to the plans of the country's Armed Forces command, and also within the framework of the ANZUS and ANZUK blocs.

According to Australia's military-political leadership's views, the character of Air Force combat operations will depend on the scale of an armed conflict, the means of combat used in it, the peculiarities of the theater of military operations and the combat make-up of Air Force groups. During peacetime, Air Force units and subunits work out the combat training missions under conditions maximumly approaching those of combat, based on possible future operations. Various firing ranges and training centers are equipped for this on the country's territory. At the same time, the Australian Air Force must widely use the appropriate bases of its allies. For example, the squadrons of P-3B and P-3C ORION aircraft, while conducting air patrols of the Indian Ocean waters, use the American base on the island of Diego Garcia and the Malaysian airbase, Butterworth (Malaysia). During such flights, they conduct search and tracking of underwater and surface targets and also guide Air Force and Navy strike forces to them.

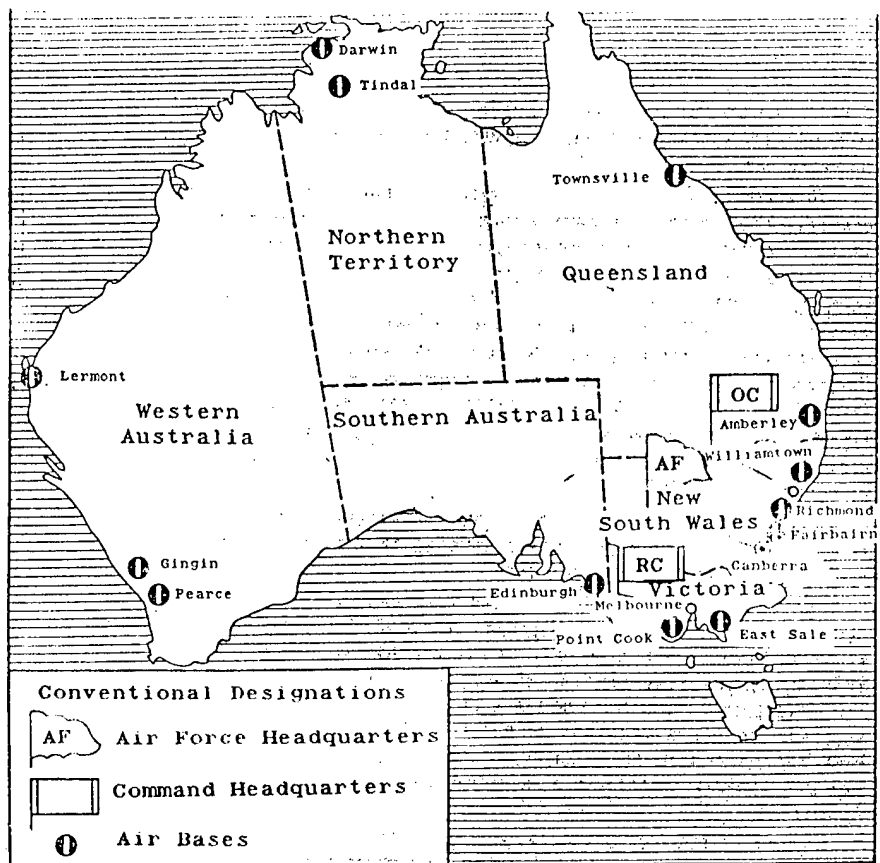


Figure 2. Schematic Showing the Principal Australian Air Force Staff and Base Locations

Fighter-bomber subunits are being trained to deliver strikes on various ground and sea targets using conventional aerial bombs and guided weapons. A great deal of attention is paid to perfect the methods of defeating the enemy's PVO system. Australian military specialists consider one of these to be the carrying out of flights at low and extremely low altitudes and at the maximum speeds possible. The crews of the other arms of the Air Force are developing this method for defeating PVO.

PVO fighter squadrons are trained to protect administrative and economic centers, and military targets by intercepting the air enemy on the distant approaches from a "watch position at an airfield" and during a patrol in an assigned zone. Simultaneously, according to foreign experts' testimony, PVO aviation is being trained to deliver strikes on ground targets.

Military-transport aviation is engaged in developing the mission of transporting personnel, weapons, military equipment and material-technical support resources, and dropping airborne assault forces. In this regard, they

operate in support of both their own armed forces and those of their allies. The exercises KANGAROO, and RIM PAC, conducted on a regular basis and in which Australia's Air Force participates, testifies to the later.

According to Western experts' estimates, the Australian Air Force's pilot force has a quite high training level. The close coordination with the U.S. regarding training issues (according to a jointly worked out method) and the system for the professional development of flight personnel promotes this. A wide network of military-training institutions was created for this in the country: the Air Force Accademy, the Central, 1st, and 2nd Pilot Schools, the Air Force Navigator School, and also two engineer-technical training centers and various advanced and retraining courses for Air Force specialists.

Future officers receive theoretical and practical military and air training for four years at the Air Force Accademy. After three years of training, the students of the pilot department are sent for six months to the 1st Pilot School (Point Cook Air Base), where they take a preliminary training course on CT-4A light exercise-trainer aircraft (the total flying time is 60 hours). The main training is carried out at the 2nd Pilot School (Pearce Air Base). During it, patrol techniques and the combat employment on MB-326H jet exercise-trainer aircraft are developed. The training lasts eight months, and the flying time is 120 hours. Upon its conclusion, the rank of 1st Officer and a pilot qualification is conferred on them. Further advanced pilot training and retraining on new aviation equipment is carried out in an Air Force's combat-training squadron, and also at training centers in the U.S. and Great Britain.

As foreign military experts figure, the AIR FORCE's DEVELOPMENT is proceeding in two directions: the modernization of existing aircraft and helicopters, and the purchase of new aviation equipment.

With regard to the first direction, they note the following. It is planned to install the modern American PAVE TACK weapon control system and gear for warning the crew that it is being painted by an enemy radar [RAW gear] on the F-111 fighter-bomber, in order to increase its combat capabilities. It is planned to adapt this aircraft for the combat use of the U.S.-produced HARPOON antiship missile and the GBU-15 guided aerial bombs. In addition, work is being carried out to extend its service time (to complete up to 2,000 hours a year). Similar measures are being carried out for their other existing aircraft and helicopters.

As the Western press emphasizes, one of the Australian Air Force's main development programs is the reequipping of fighter squadrons with the new American F-18 HORNET aircraft. For this, 75 such fighters were ordered (two of them were constructed in the U.S. and flown to Australia, and the remaining are being assembled at the government aviation factory at Melbourne). They plan to replace their existing older MIRAGE-3 fighters with the F-18 aircraft.

The F-18 HORNET multi-role fighter has higher tactical-technical characteristics and more powerful armament than the MIRAGE-3. In particular, it can carry the most recently modified AIM-9 SIDEWINDER and AIM-7 SPARROW air-to-air guided missiles, the HARPOON antiship missiles, and conventional and guided aerial bombs and other modern weapons.

According to foreign press reports, the first four F-18 HORNET aircraft were delivered to the Australian Air Force in May 1985, at Williamtown Airbase, where a retraining center opened. By this time, six Australian pilots had already completed the retraining course on the F-18 aircraft at the U.S. Naval base, Lemoore [California]. The first group of pilot-instructors for personnel retraining were formed from them.

It is planned to equip the 3rd, 75th and 77th Fighter Air Squadrons with F-18 aircraft. Crew retraining for the 3rd Air Squadron is expected to begin in 1986, and, by the beginning of 1989, all three of the Air Force's reequipped squadrons will be retrained. As a result, it is planned to rebase the 75th Fighter Air Squadron at the new air base at Tindal, and the 3rd and 77th Fighter Air Squadrons at Williamtown. Their crews, in turn, will stand combat watch at Butterworth (Malaysia), fulfilling the missions executed up until this time by the 3rd Fighter Air Squadron.

To further increase Air Force combat capabilities, the country's military leadership intends to purchase long range radar detection (DRLO) and control aircraft [airborne warning and control aircraft] from the United States (according to foreign experts' opinions the selection is narrowed to the P-3AEW AWACS aircraft developed in the U.S. based on the P-3C ORION base patrol aircraft.) They also intend to convert their existing Boeing 707 transport aircraft to tanker-aircraft. In addition, it is planned to replace the P-3B aircraft existing in the Australian Air Force's inventory with P-3C, which are equipped with more modern radars, electronic equipment and weapon systems.

In considering, that new, more complex aircraft (such as the F-18), are being adopted into the inventory, the country's Air Force command is directing specific efforts at improving the pilot training program. For this purpose, it is planned to replace the older exercise-trainer aircraft with more contemporary ones. In particular, as the Western press notes, it is intended to purchase around 70 new TOUCANO exercise-trainer aircraft.

In addition to the ones mentioned above, other measures directed at increasing its combat capabilities are being carried out in the Australian Air Force. All this is for the purpose of increasing Australia's role in the region and is highly encouraged by the Pentagon, which sees the country as a staging area for carrying out its aggressive plans, both in the Indian Ocean region and the southern part of the Pacific, and on a worldwide scale.

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FOREIGN MILITARY REVIEW

AMERICAN AIR FORCE RADIO COMMUNICATIONS SYSTEMS/EQUIPMENT

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 3, Mar 86 (Signed to press 4 Mar 86) pp 38-42

[Article by Col M. Mikhov, Maj A. Dashin, Candidate of Technical Sciences; "American Air Force Radio Communications Systems and Equipment"]

[Text] In general, the aggregate of militaristic preparations, currently being carried out by the Pentagon, the improvement of communications systems and equipment constantly is being accomplished as one of the main elements of the force control process, including the Air Force. A wide collection of systems are used in the U.S. Air Force's radio communications, which, depending upon the radio frequency bands, the radiated power, the paths of radio signal propagation, and its internal structure, execute the following primary missions:

- The accomplishment of short-range radiotelephone command, and in a number of cases, of digital communications between aircraft in the air, and also with ground and air control posts using onboard radios operating in the 225-400 MHz range, with which all aircraft and helicopters are equipped;

- the coordination of tactical aviation with the army's ground troops using radios operating in the 30-88 MHz frequency range;

- air traffic control in areas of heavy civil aviation traffic by communications with national and international control centers in the range of 108-152 MHz for strategic and military transport aviation aircraft, and also special-purpose aircraft;

- the provision of long-range radio communications for strategic, military transport and reconnaissance aircraft using HF radios operating in the 2-30 MHz range;

- The accomplishment of global radio communications for strategic aviation using the AFSATCOM satellite system operating in the ultrashort wave frequency band of 225-400 MHz;

- The control of the personnel and equipment of the U.S. Air Force's Strategic Air Command from airborne command posts, and, if necessary, of the

country's armed forces and of NATO's Allied Armed Forces using very long wave (VLF) radios operating in the 12-60 KHz frequency range and a strategic multichannel satellite communications system operating in the centimetric (SHF) band (frequencies 7-8 GHz).

In accordance with foreign press reports, the most widely deployed onboard aircraft communications systems in the U.S. are ultrashort wave radios using various frequencies, and among them are decimetric (UHF) wave band radios, corresponding to the frequencies of 225-400 MHz. At the beginning of the 1970s, when the transition from vacuum tube to semi-conductor communications equipment occurred, the U.S. Air Force command announced a competition for the development of a standardized radio in this band. In 1974, the selection was narrowed to the AN/ARC-164 radio developed by Magnavox, which began to replace the different types, older AN/ARC-21, -34, -51, and -109 radios.

The AN/ARC-164 radio, being completely solid-state with extensive use of integrated circuits, is characterized by relatively light weight (around 3 kg), fairly high reliability (the mean time between failures is more than 1000 hours) and compactness (the dimensions are 12.7x12.7x19.3 cm), which permits it to be placed in the cockpit instrument panel. In the given band, the radio has 7,000 fixed frequencies, with a separation of 25 kHz, 20 of which can be pre-set and any of the remaining can be set during flight using five switches. The frequency synthesizer's temperature compensation creates a relative frequency shift of 1.5×10^{-6} in the operating temperature range from -55 to +71°C, which provides a free-from-tuning frequency setting accuracy of ± 2.5 KHz in the upper portion of the operating range. In addition, the radio has an independently operating duty receiver at 243 MHz. The 10 W radiated power is considered by American military specialists to be adequate for short-range, tactical-level communications and the small current consumption simplifies the radio's electrical operating mode which permits it to be turned on with the electric power from a battery before the starting of the aircraft's engines.

In 1978, the AN/ARC-186 radio was developed, for use in other ultrashort wave bands, replacing two separate radios operating in the 30-88 MHz and 108-152 MHz frequency ranges. The radio has 4,080 fixed frequencies in these bands, of which 20 can be pre-set. The AN/ARC-186 possesses a similar component-technology base with the AN/ARC-164 radio; the radiated power is 10 W, the weight approximately 3 kg, and the dimensions 12.4 x 14.5 x 16.5 cm. It was noted in the foreign press, that approximately 4,000 such radios were ordered for the U.S. Air Force in 1984. It was also reported, that all American ultrashort wave aircraft radios are capable of operating in a secure communications mode with the presence of an onboard KY-28 or KY-58 telephone coder.

U.S. Air Force aircraft became the first to use the decimetric band for satellite communications. In particular, with the launch of the TACSAT-1, LES-5 and LES-6 communications satellites at the end of the 1960s, an experimental satellite communications system began to be used on airborne command posts, and the communications capabilities of F-4 tactical fighters and KC-135 refueling aircraft through a satellite were actually tested at the beginning of the 1970s. In 1977, the U.S. Air Force command decided to equip

its strategic aviation with satellite communications, and by 1985, 231 radios of the AFSATCOM satellite communications system were installed on B-52 bombers and FB-111s, EC-135 and E-4 airborne command posts, and RC-135 reconnaissance aircraft. By 1986, it was planned to bring the number of correspondingly-equipped aircraft to 920, including part of the tanker fleet and military transport aviation.

Communications in the AFSATCOM system are carried out in a telegraph mode at a rate of 75 bits/second (approximately 100 words per minute), and according to American military experts' opinions, permits commands and orders to be transmitted, and also information to be exchanged within the control process for the U.S. strategic forces. It is considered, that the LES-8 and LES-9 new-generation communications satellites, launched during the mid 1970s into geostationary orbits, provide quite reliable functioning of the system. Judging by foreign press materials, voice communications (in the telegraph mode) through satellites, carried out in support of the U.S. Air Force's operational-tactical network in the 225-400 MHz frequency range, has still not been extensively employed in the Air Force. Specifically, radios of this type include the AN/ARC-171 (transmitter power of 30 W in the telephone amplitude modulation mode and 100 W in the frequency modulation mode with the transmission of data), are installed on individual special-purpose aircraft, such as the E-3 AWACS airborne early warning and control system aircraft.

Superlong (kilometric) and centimeter wave band radios occupy a separate place among the U.S. Air Force's aircraft communications systems. But because of the peculiarities of constructing power amplifiers and antennas in these bands, they can not be extensively used in aircraft. At the same time, radios in these bands play an important role in the onboard equipment make-up of the airborne command posts' (ACPs'), being seen by the U.S. military-political leadership as an important integral element of the global operational control system of the country's armed forces. The U.S. Air Force's SAC ACPs on EC-135 aircraft (reequipped Boeing 707 airliners), put on combat watch in the air on an around-the-clock-basis since the middle of the 1960s, are considered by the Pentagon to be a necessary reserve control element of the country's armed forces during the delivery of a nuclear strike.

VLF radios in the 12-60 kHz band occupy an important position in the onboard equipment make-up of these aircraft. According to American military specialists' assessments, to a large extent the signals of this band maintain their propagation capability in an ionized atmosphere resulting from a nuclear explosion, and also penetrate through the sea's surface layers, permitting submarines to receive control commands while submerged. For the effective emission of radio signals in this band, an unwieldy extension antenna, comprising a cable having a length up to 8,000 m, is used on the aircraft, and also complex design measures for preventing an electrical break-down in the transmitter's output circuits are employed. Nevertheless, judging by foreign press reports, American Air Force specialists were able to implement completely the capabilities of aircraft VLF communications only on the significantly heavier ACP belonging to the Joint Chiefs of Staff and the president, deployed on the E-4B (a reequipped Boeing 747 airliner). The power of the VLF radio on the E-4B aircraft was increased to 200 kW (almost 10 times greater than that of the radio on the EC-135 aircraft), and the design of the

extension antenna is significantly more complex, including the addition of a counterweight with a length of more than 1 km. The large energy requirement of VLF radios forces special measures to be adopted to provide power to the E-4B aircraft's equipment by the installation of eight generators with a variable frequency current of 400 GHz and a total power of 12 kVA.

While accumulating experience in the use of aircraft VLF communications, the U.S. Air Force command intends to expand the scale of its use, adding yet the control of strategic aviation to the mission of supporting the cooperation with ground centers and submarines, for which it is planned by the beginning of the 1990s to equip strategic bombers with VLF radios.

A satellite communications radio operating in the centimetric wave band (frequencies 7-8 GHz) is another special means of communications on the E-4B aircraft. It is considered that in comparison with the frequency band of 225-400 MHz, more widely used in the American Air Force, the centimetric band provides highly secure communications (due to the high operational directivity of the antenna) and significantly increased information exchange capacity, including digital information, due to the wide signal band and the potential for organizing multichannel communications. The power of the radio's onboard transmitter is 10-11 kW. A parabolic satellite-tracking antenna with a diameter of 91 cm is located in the upper part of the E-4B's fuselage under a special dome.

In analyzing the modern make-up of the Air Force's radio communications systems and equipment, American military experts consider that their main deficiencies are the comparatively high vulnerability to radioelectronic jamming, the lack of general-purpose relay stations for communications between distant radio stations outside the limits of direct visibility, the inability to organize conference telephone communications between aircraft in the air, the unsatisfactory characteristics of the terminal unit for transmitting and processing digital data, and the high probability of intercepting transmitted radio signals, allowing the aircraft's position to be easily determined.

To eliminate these and several other inadequacies, and also to satisfy the growing requirements for communications systems and equipment, a number of programs, considered for near and long term adoption, were instituted in recent years in the U.S. for U.S. Air Force support. JTIDS (Joint Tactical Information Distribution System) was one of the first attempts to change radically the organizational structure of radio nets, based on the allocation of fixed radio frequencies to distant stations manually. The so-called multiple access terminals, based on the time division of communications channels TDMA (Time Division Multiple Access), was used in it for the first time. It permits distant stations to receive all the information, circulating in the net by a rigid allocation of a time "slot" for receiving and transmitting between them. The system's jam-resistance is provided by a pseudo-random switching of fixed frequencies within the given band from 960-1,215 MHz. The JTIDS is intended primarily for the exchange of digital information at a rate of 28.8 or 57.6 kbits/second in a pulse, depending upon the duration of the information pulses. In addition, limited voice communication is possible on it, but with a sharp decrease in the number of distant stations in the net.

The system became operational at the beginning of the 1980s, when it was incorporated into the E-3 Airborne Warning and Control System (AWACS) Aircraft's equipment and the deployment in Western Europe of a net of ground centers with radios for organizing the interaction of the E-3A aircraft with NATO's NAEGIS automated air defense control system. For the subsequent phase, it is planned to equip U.S. and NATO air defense fighters with the radios, first the F-15 EAGLE aircraft. The further development of the JTIDS is slowing down, in Western military experts' opinions, because of the limited capabilities for providing voice communication, without which the adequate effectiveness in organizing tactical aviation's combat operations cannot be conceived.

Therefore, in support of U.S. Naval Aviation, the so-called Distributed Time Division Multiple Access system is being developed, in which supplementary time is used--the pulse coding of bits. They believe, that an analog signal structure will provide the compatibility for several nets in the system in one geographic region and voice communications for an adequate number of distant stations. An improved variant of JTIDS, the EJS (Enhanced JTIDS System) is being developed in support of the U.S. Air Force, which must first satisfy the requirements of the Tactical Air Command for voice communications. In accordance with foreign press reports, at the present time, until the wide-scale adoption of JTIDS, (expected not earlier than the end of the 1980s), the U.S. Air Force command has adopted decisive measures to provide tactical aircraft with jam-resistant voice communications.

In 1975, technical proposals were drawn up for organizing stable air-to-ground radio communication links by radiotelephone during radioelectronic jamming. In 1976, the program SEEK TALK was formulated, which was intended to use the latest achievements in radioelectronics to support adaptive control using frequency modulated radio signal parameters and the directivity of the antenna systems in radio links to automatically tune out jamming signals. However, in that the deployment prospects for such systems is not earlier than the second half of the 1980s, the U.S. Air Force command switched, at the beginning of 1977, to implementing the intermediate and technically more simple HAVE QUICK program. For the task's practical execution, it was proposed to use the operations of radios in radio links having an adequately fast fixed-frequency hopping capability within a wide band. Such a method, which allows existing communications equipment to be used with minimum modifications, was acknowledged as being the most expedient. Force trials of the new system were conducted in the autumn of 1979, and in May 1980, the modification of the first lot of AN/ARC-164 radios (900 units) was already ordered for operations in a jam-resistant mode.

The operating frequency's hopping in the radios's jam-resistan mode (several hops per second) is carried out on a pseudo-random principle, changing according to a special code each day. Single time signals, relayed by the TRANSIT satellite navigation system, are used for the synchronization of hops; signal relay is also possible by ground control centers. The synchroniztion of and aircraft radios is carried out before the take-off on a combat mission, however this proceedure is fairly simple, and can be carried out semiautomatically whenever the radio is turned on. It is considered that

by equipping a portable unit with an atomic generator with a standard frequency, a ground station acts as an independent synchronizer.

By the beginning of 1985, several thousand radios, both onboard and the ground portable and mobile ones of forward air controllers, were modified under the HAVE QUICK program, which according to American expert's opinions, testifies to the potentially extensive use of a jam-resistant communication mode for the U.S. Air Force's tactical aircraft. Measures of a similar nature were adopted by the ground forces command in the SINCGARS (Single Channel Ground and Airborne Radio Subsystem) program, in accordance with which a frequency hopping operations mode for radios in the 30-88 MHz frequency range was introduced. In view of the combined operations of both branches of the armed forces, AN/ARC-186 radios existing in the Air Force's inventory, are undergoing corresponding modification in compliance with this program.

In the realm of improving HF aircraft radio communications, the U.S.'s main efforts are being directed at increasing the stability and reliability of radio links. As is known, the conditions for signal propagation in the HF band are determined to a large extent by the state of the atmosphere's ionospheric layers and continuously changes for various portions of the band. American specialists consider that, for reliable around-the-clock operations of long-range HF radiocommunications links, continuous adaptive tuning of the transmitter and receiver is necessary for the most optimum operational frequency at a given moment of time. In view of the large distance between the transmitter and receiver, the external synchronization of their operations is acknowledged as being inadvisable. An adaptive organizational system for an HF radio link, according to U.S. Air Force specialists' plan, is built upon the following principles: the successive transmission by the transmitter of the operating frequency band with definite spacing; the search and following of the transmitter signal by the receiver; the analysis of the communication quality on the receiver side according to a "signal-to-noise" principle and the frequency of transmission errors; the formulation by the digital processor of a priorities list of a fixed frequencies group; the organization of communication between distant stations using frequency hopping according to an optimal pseudo-random principle within the limits of the fixed frequencies priority group.

According to foreign press reports, the U.S. Air Force command has now started to implement the first operational phase for increasing the effectiveness of HF radio communication by equipping strategic aviation aircraft with the new AN/ARC-190 radios, capable of operating in an automatic search system for the optimum communication frequency. According to American military experts' opinions, the implementation of the measures discussed above will permit the Air Force's combat operations in various theaters of military operations to be controlled more effectively.

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FOREIGN MILITARY REVIEW

AUTOMATION OF FIGHTER ONBOARD SYSTEMS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 3, Mar 86 (Signed to press 4 Mar 86) pp 43-46

[Article by Lt Col O. Nikolskiy and Capt G. Isayev; "The Automation of Fighter Onboard Systems"]

[Text] The imperialistic governments' military-political leadership, in preparing for war against socialist countries, are paying unremitting attention to the development of fighter aviation. As a result of this, the tactical-flight characteristics of aircraft are constantly being improved and their combat employment tactics perfected. It is noted repeatedly in the foreign press, that, at the same time the control of supersonic fighters (especially single-seat ones) is becoming more complicated, it is approaching the limits of man's psycho-physiological capabilities. Therefore, inspite of the improvement in the quality of pilot training, in a number of cases, they cannot guarantee safe piloting, do not use the aircraft's potential capabilities to the fullest extent, and are not able to operate effectively in combat conditions.

With the appearance of new-generation F-14, F-15, F-16 and F-18 fighters in the U.S., equipped with a significant number of complex onboard systems and distinguished by high maneuverability, the problem of the human factor in the control of aircraft is more aggravated. In foreign military specialists' opinions, it is only possible to successfully solve this problem by reducing a pilot's attention load by removing some of the aircraft control functions from him and making the use of onboard systems easier. It is considered possible to achieve this by automating fighters' onboard systems while at the same time organizing them, and also by improving systems with the aim of reducing their complexity.

It was reported in the foreign press, that extensive theoretical and experimental research, directed at developing automated onboard systems intended for installation on both contemporary and future fighters, is presently being carried out in the leading capitalistic countries. Thus, a special commission comprised of specialists from the Department of Defense, civilain aviation, industry, the National Aeronautics and Space Administration (NASA), and universities made a thorough assessment of the potential development paths of such systems for single-seat fighters. The commission's

report, sent to the U.S. Air Force command, emphasized the necessity to develop in the future automated systems along a systems approach on the level of the aircraft as a whole, since it is more advisable than the automation of individual components, which can only lead to insignificant improvements with large expenditures. It was also noted, that the primary task must be to automate the aircraft's flight trajectory and attitude control functions. In compliance with the systems approach, such an automated system is the nucleus, on the basis of which the remaining systems will be organized for implementing a completely automated fighter.

American specialists reached such a conclusion on the basis of research, during which the development priority of automated systems necessary for planning their further development was determined. During the research, they followed the expert assessment method, in which pilots and air force commanders of various ranks acted as experts. Using this method, through the use of relative weighted coefficients, all onboard systems were divided into four groups depending on two factors--the complexity of the systems' use and the frequency of the pilot's reference to them during combat, and other phases of flight.

As a result it was established, that the following systems have the highest priority for automation and comprised the first group: the flight control system; the weapons and power plant control system; the system for positioning the aircraft at the weapon launch point; the taxi, take-off and landing control system. It was considered that these functions do not complicate the pilot's work, but often require his attention.

The second group includes the target search and lock-on system, the system for receiving input information, the threat detection and reaction system, and the cockpit equipment. They are distinguished by being highly complex which often distracts a pilot's attention. It is considered, that in the beginning one should improve such systems in order to simplify their use, and then to accomplish their automation.

The third group includes the navigation, aircraft's emergency escape, and IFF systems. Although the pilot seldom refers to them, nevertheless, these systems are quite complicated to use. Therefore, the issue of their automation must be decided after they are perfected for easing a pilot's work load.

The following systems belong to the fourth group: the autopilot system, electro- and gyroscopes, malfunction detection system and the fuel expenditure control system. At present it is considered inadvisable to automate them since they are comparatively uncomplicated and seldom distract a pilot's attention.

The commission recommended in its report that the following systems be combined into one automated complex; the flight control system, weapon systems, power plant and navigation system. As American experts figure, this will permit a pilot to focus his main attention on the functions of threat detection and reaction, target search and lock-on, and positioning the aircraft at the weapon launch point. According to their opinion, in this

regard, the automation of fighters' onboard systems will give the required effect only if it is supplemented by future means of depicting information and control organs. The latter must be developed based on factors connected with man's participation in the control loop and in compliance with the pilot's mental notions about the nature of his combat mission. Presently, experimental types of displays have already been developed, which graphically depict the possible launch zones of antiaircraft missiles with an overlay of the aircraft's flight path and remaining fuel, and they also provide a terrain map display.

The commission recommended carrying out further development of future automated systems and their components for fighters of the 1990s. In accordance with foreign press reports, the U.S. Air Force has already ordered that similar systems be developed, in particular, an automated IFF system and various types of devices for detecting and identifying jet engine aircraft. In addition, research on a number of new automated systems has started: self-restoring systems, which maintain the work capacity when damaged by a shell hit or an internal malfunction; control systems using voice commands which permit corresponding pilot-fed commands to change the representation scale on the radar display, depicting the distance of 260 or 65 km on it; helmet-mounted sights ensuring the transmission of information about the line of sight to the target into the computer, which selects the type of weapon for its destruction.

On the basis of the commission's recommendations, the Air Force initiated a five-year research program of combat aircraft's control functions. Its goal is to determine the priority for automating these functions and their subsequent organization with others. In particular, it is planned during the program: to study a pilot's workload during various control functions; to conduct computer modeling in order to determine the automation level for various systems; to assess the potential automation levels with the criteria of maximum combat effectiveness. As a result of carrying out the program, it is planned to produce a manual on the emergence of those pilot functions, which can be automated, and also to work out the methods for assessing the consequences of this automation.

According to foreign press evidence, currently, in the U.S., the main efforts are being directed toward the development of complex automated flight and weapon control systems (ASUPO). For example, the flight trials of experimental models of systems are already being conducted, which represent the implementation of two different concepts for the development of complex ASUPOs; the analog FIRE FLY system installed on the two-seat F-15B fighter, and a digital system with which the single-seat AFTI/F-16 fighter is specially equipped. Foreign experts confirm that aircraft equipped with such systems obtain important tactical advantages and will have improved fire accuracy and greater survivability during operations against aerial and ground targets.

The FIRE FLY integrated analog ASUPO is being developed by McDonald Douglass, and General Dynamics under the auspices of the Air Force. The ASUPO combines the following functional subsystems: the ATLAS-2 electro-optical sighting device, located in a suspended container and consisting of a television unit for target detection and lock-on; a laser-rangefinder (which gives

information on target coordinates, the angular velocities of the line of sight, tracking errors, and range to the target); an onboard radar (information on the target coordinates, the angular velocity of the line of sight, and range to the target); a central computer (the control of the primary operations modes, the coordinate calculations of a detected ground target); a navigation system (information on the aircraft's coordinates and spatial position, and the angular velocities of its movement); an air parameters [air signals] computation unit (information on the air speed, attack angle, relative air density, and barometric altitude); and flight control sensors (angle velocities and the aircraft's acceleration).

The tracking unit, which is a digital information processing unit working in near real-time, forms the basis of the ASUPO. It includes a central processor, a 32,000-word capacity memory unit, a multiplex bus end unit, analog and digital converters, and an information input-output unit. The ASUPO's operating program is preserved in the memory unit in the form of the following ten programming models: preliminary information processing (the preprocessor), the radar, the navigation system and ATLAS-2 unit, the assessment of the aircraft's status, the conversion of the aircraft's stabilization axes, the determination of target coordinates, target designation, the equations for predicting missile and cannon fire, the bombing run equations, and the miss determination.

An assessment of the ASUPO, conducted by foreign specialists on a simulator, showed that during cannon fire against air targets, the reliability of hitting the target with a projectile increases by a factor of two, and the duration of weapon employment, fourfold. During operations against ground targets, the aircraft's vulnerability to enemy air defense system fire is decreased tenfold.

During aerial combat, the FIRE FLY ASUPO functions as follows. After target lock-on, using the onboard radar or the ATLAS-2, information on its precise position and angular velocities are entered into the onboard weapon control computer system. In addition, information on the range to the target and the approach velocity can be entered into it. Then the signals of the exact aiming position point are illuminated on the display depicting the information on the windshield, and are simultaneously transmitted to the autopilot and flight control system, which insures the aircraft's automatic positioning to the weapon launch zone according to the existing program. As a result, the ASUPO permits the aim position point, depicted on the display, to be maintained in the center of the zone of allowable control error.

During operations against ground targets, target lock-on is accomplished using the ATLAS-2 system and, depending upon the target characteristics and type of interference, the tracking unit is used for comparison with a surface correlation unit. While positioning the aircraft to the weapon launch point, the target is not required to be kept in the center of the display, permitting a deviation from the usual horizontal direct-line approach to the target, since this sharply increases the aircraft's vulnerability to ground air defense fire. American specialists believe that, by using the ASUPO, a pilot can deceive the enemy, selecting a flight path which does not presume active

operations against the target, and then to surprisingly complete the maneuver and employ the weapons (Fig. 3).

During the flight trials of the F-15B aircraft, using the FIRE FLY ASUPO, two bombing methods were tried out. The first, receiving the name "minimum time," featured positioning the aircraft in an unsteady banking turn so that the velocity vector was directed at a point behind the target. The second method was the "maximum maneuver" in which the aircraft's velocity vector, at the beginning of the attack is directed at a point ahead of the target. Such a method requires the execution of slip and large g-load maneuvers. For this, piloting is carried out by the pilot manually according to information depicted on the display

or, automatically. At the end phase, the aircraft's control is completely automated. During operations against ground targets using the MAVERICK guided-missile, the fighter's positioning in the missile launch zone is carried out automatically along a curvilinear path, which reduces its vulnerability to antiaircraft fire. Before breakout into the launch zone, the aircraft automatically completes a climbing maneuver to a given altitude for target lock-on by the tracking unit, during which the corresponding control signals are depicted on the display.

According to foreign military experts' opinions, the results of the FIRE FLY ASUPO operations may be the basis for the development of a new digital system for the F-15 fighter.

An integrated digital ASUPO is being developed by General Dynamics within the limits of the AFTI/F-16 research program. According to American experts' opinions, it possesses greater capabilities than the FIRE FLY ASUPO and may become the basis for the development of a future ASUPO for the F-16 aircraft and fighters of the 1990s. With the implementation of a digital ASUPO, the possibility of employing more complex control principles is being considered, which is connected with the necessity to process a large volume of information, at a high speed of operations and with precision computations, but with less unit weight and volume. An ASUPO also permits new-in-principle maneuver modes to be carried out, which essentially increases fire accuracy and decreases vulnerability to the fire from ground air defense systems.

The make-up of such an ASUPO includes air parameter [air signals] sensors, a radar, a forward looking IR unit, a radioaltimeter, a navigation system, a weapon control system, an electric-powered flight control system, a helmet-mounted sight, a voice-commanded control unit, and an arming device for weapon fuses. The necessary information is depicted on multifunction displays, installed in the cockpit, and the information exchange between ASUPO units is

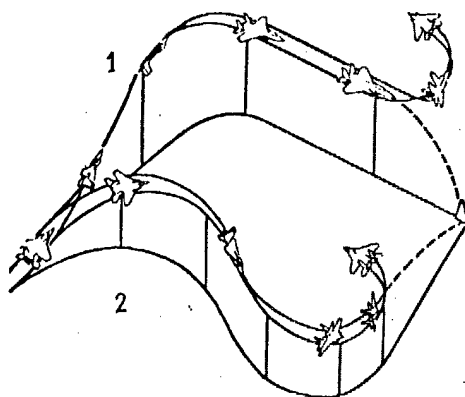


Figure 3. F-15 Fighter's Bombing Flight Path.

1. Standard F-15.
2. F-15 with FIREFLY ASUPO.

carried out using multiplex busses, along which pass the commands for selecting the piloting modes, and information from the air parameters sensors, the target characteristic parameters, and also from the inertial navigation system. A digital ASUPO enables the aircraft's automatic control during combat. Therefore, the main attention is being paid to the automation of control during the weapon launch phase, but not during the combat approach or the breakaway phases. At any moment the pilot can mix the weapon control process, selecting its semiautomatic or manual control.

It is reported, that an ASUPO permits cannon fire to be conducted against an air target from any aspect in which the tracking accuracy is not more than 2 mrad and a threefold increase in the reliability of a hit is provided as a result of a large angular velocity of the line of sight. (Fig. 4). An attack against ground targets from low altitudes, and a bombing run from a horizontal, dive, and pitchup flight mode can be carried out. An ASUPO insures the minimum loiter time in the enemy's antiaircraft artillery operational zone, since the dropping of bombs and cannon fire can be carried out from a turn, because the necessity for a pass over the target is eliminated.

According to foreign press reports, it is planned to perfect the ASUPO further and connect the power plant control control system to it, and also to investigate the possibility of using an ASUPO for flight in a terrain following mode. In 1983, the first phase of flight trials of the AFTI/F-16 aircraft

with a digital ASUPO ended, during which the principles of flight control in conformity with each mission were verified. It was planned to initiate the second phase in 1984, the goal of which was to assess the effectiveness of the aircraft's position to the fire line, and also to work out principally-new tactical methods.

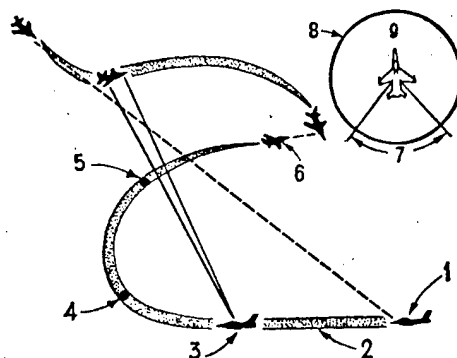


Figure 4. Cannon Fire From an AFTI/F-16 Equipped with a Digital ASUPO:

1. Onboard radar locks on target.
2. Target tracking.
3. Electro-optical units locks on the target.
4. Turn to the target
5. Switch on the ASUPO.
6. Open fire with the cannon.
7. Usual optical sight field of view (80°).
8. Field of view of the ASUPO sensor (360°).
9. Target.

According to foreign military experts' opinions, the measures implemented for automating the onboard systems of fighters not only increases their combat capabilities, but also reduces the dependence on flight training for successfully completing missions.

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FOREIGN MILITARY REVIEW

AIRCRAFT SONOBUOY SYSTEMS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 3, Mar 86 (Signed to press 4 Mar 86) pp 56-60

[Article by Capt 3rd Rank A. Borodavkin and Capt 2nd Rank V. Babich; "Aircraft Sonobuoy Systems"]

[Text] The high commands of capitalist navies, in their constant striving to increase the combat power of their fleets, are directing special attention to improving antisubmarine forces and systems, including ASW aircraft whose numbers continuously increase. In addition, ASW weapons, including sonobuoys (RGB) in particular, which enable detection and covert tracking of submarines at any time of the day and in any sea states are being modernized.

RGB systems, as a rule, consist of active or passive RBGs, systems for their storage and ejection, equipment for signal reception and processing as well as for display and cataloguing data.

This article reviews sonobuoy systems of the ASW aircraft of the U.S., Great Britain, France and Canada.

In the U.S. Navy and several other capitalist navies, widespread utilization was made in the early 1960s of the active JULIE sonobuoy system. Its operating principle is based on echo-sounding of the water medium using small caliber depth bombs as the explosive sources of sound energy; on receipt by passive sonobuoys of the direct signal and that reflected off the target; and the determination, by the time difference of receipt of these signals, of the detected target's location. To do this, special depth bombs and sonobuoys were ejected from an aircraft. The sonar signals, transmitted by radio channel from the sonobuoy, were received and processed on board the aircraft with special radio receivers and the AN/AQA-1 acoustic processor. This system permitted locating submarines quite accurately, but had a very short operating range. Naturally, using explosive sources for sound signals as the active element of the system turned out to be its real shortcoming, since through the explosions the submarine could easily establish the moment the ASW forces commenced searching and could begin evasive maneuvers. This system is no longer in use in the U.S. Navy. This shortcoming does not occur in the JEZEBEL passive sonobuoy system, also developed in the early 1960s. It incorporates AN/SSQ-41B passive sonobuoys (see Table), the AN/AQA-3A acoustic processor (later

Table

PRINCIPAL CHARACTERISTICS OF AIRBORNE SONOBUOYS

Sonobuoy System (Type Buoy) Country	Operating Mode	Freq. Band of Acoustic Channel, kHz	No. of Tuned Radio Channels	Dimensions Diameter and Height, mm
	Directivity	Antenna Release Depth, m	Operating Life, hrs	Weight, kg
JEZEBEL (AN/SSQ-41B) U. S.	Passive	.01-10	31	915 x 124
	Directional	18; 305	1; 3; 8	9
DIFAR (AN/SSQ-53B) U. S.	Passive	.01-2.4	99	915 x 124
	Directional	27, 122, 305	1; 3; 8	11.3
DIFAR (AN/SSQ-77A) U. S.	Passive	.01-2.4	99	915 x 124
	Directional	305	1; 8	13.1
CASS (AN/SSQ-50B) U. S.	Active	---	31	915 x 124
	Omni Direct	18; 457	.5; 1	--
DICASS (AN/SSQ-62B) U. S.	Active	4 Channel	31	915 x 124
	Omni Direct	27; 119; 457	0.5	17.7
JEZEBEL (SSQ-904) U. K.	Passive	0.005-6	31 or 99	305 x 124
	Omni Direct	18; 91 or	1; 4; 8 18; 137	4.5
CAMBS (SSQ-963) U. K.	Active	---	31	915 x 124
	Directional	---	--	15.9
RANGER (SSQ-947B) U. S. /U. K.	Active	13-19	12	915 x 124
	Omni Direct	18; 244	0.5	13.2
DSTA-3B France	Active	4 Channel	8	915 x 124
	Omni Direct	20; 100	0.3	16
DSTV-7Y France	Passive	0.01-24	99	305 - 124
	Omni Direct	20; 100	1; 3; 8	---
BARRA (SSQ-801) Australia	Passive	0.01-2	31	915 x 124
	Directional	25; 135	0.5-9	13

replaced by the AN/AQA-5, by which they could increase the number of RGB signals processed simultaneously from 8 to 16), the AN/ARR-52 radio receiver, AN/AQH-1 recorder for taping acoustic signals and the AN/ASA-16 data display. Despite the relatively low accuracy of target bearing information, foreign specialists consider that the effectiveness of JEZEBEL to be quite high.

At the end of the 1960s, DIFAR, a more modern passive sonobuoy system began to replace JEZEBEL. DIFAR includes the AN/SSQ-53B and the AN/SSQ-77A sonobuoys, the AN/AQA-7 (V)1/2 acoustic processor, linked to the AN/ASA-84 central navigation system, AN/ARR-72 acoustic signal receivers, AN/AQH-1(V) acoustic recorder and the AN/ASA-70 and 66 data display equipment.

The AN/ASA-70 includes a multipurpose display of tactical data (386 mm in diameter) on which is displayed alpha-numeric data, symbols, and various pointer/cursors. To display and evaluate data input into the computer memory, the operator employs an auxiliary scope (127-mm diameter). Using an on-board computer, the operator can designate and display target location and course, select a display scale, single out, query and assign signals from various sonobuoys for processing on the AN/ASA-66 display terminal (diameter, 230 mm). The location of the aircraft and the ejected sonobuoys are indicated automatically.

The combat capabilities of the DIFAR system, according to the foreign press, grew after it was incorporated into the radio-electronic tactical command and control display system in support of the A-NEW ASW system, in which surveillance information is processed by computers.

Sonobuoy signals, received by the AN/ARR-72 equipment, are processed by the AN/AQA-7 processor which permits the detection of a submarine with a very high probability and highly accurate computation of its coordinates and elements of its movement.

A more modern signal processor, in particular, the AN/ASQ-114 computer, made by Sperry Univac, has permitted reduction of the ORION maritime patrol (ASW) aircraft crew from 12 to 10. In addition, it presents data on displays in real time. Thanks to automation, the time required to make decisions in critical situations has decreased by an order of five.

The computer and the airborne radar systems are linked together through the AN/AYA-8B processor and data display, which consists of four basic logic blocks. One of them contains receivers for the sonobuoy signals which are computer-tuned. Each of the 20 channels, designated for signal processing of sonobuoy signals, can be tuned automatically by a program (or manually) to 31 discreet frequencies stored in the computer memory. The computer identifies channel loading, whether or not there is interference and also takes into account the time of operation of each sonobuoy. Overall, equipment in the A-NEW system can scan ten times more bands of the acoustic spectrum than in previous systems.

During accomplishment of the third phase of the P-3C ORION landbased patrol plane, the A-NEW system was modernized. In conformity with this program in 1975, the AN/AQA-7 (V) DIFAR analysis and processing system was installed in

the P-3C, increasing the range and bearing accuracy against submerged targets. Four new AN/ARR-75 receivers simultaneously receive signals from 16 sonobuoys. Each receiver can be tuned to the channel of any given sonobuoy, which significantly increases the flexibility of their use, in contrast to adapting fixed tuning of each receiver to its channel described earlier.

By 1977, the passive AN/ARS-3 system had been designed to determine the locations of ejected sonobuoys, taking drift into account; the AN/AQA-7(V)6 acoustic processor of the DICASS system, and the AN/AQH-F(V)2 28-channel magnetophone, which, even as foreign specialists claimed, achieved practically instantaneous data processing using a central computer.

The installation of the AN/ARS-3, according to the foreign press, represented a giant step on the path of increasing the accuracy of sonobuoy emplacement, and therefore the accuracy of determining the submarine's location. Earlier, dropped sonobuoy locations were marked by smoke flares, by light signals at night and by bright colored water dyes in the daytime. To determine the locations of the sonobuoys it was necessary to overfly them. Visual observation of the sonobuoys meant low accuracy in determining location, impossibility to account for movement due to drift and a dependence on weather conditions. In the AN/ARS-3 systems, these shortcomings do not exist and direction to sonobuoys is determined by time differences in signal reception from various RGBs by a dispersed antenna system in the aircraft. The importance of sonobuoy bearing deviations are measured and processed by the computer, after which RGB locations accounting for drift are furnished.

Starting in 1980, the AN/ARC-143B (225-400 MHz) UHF communications unit came into use, ensuring a channel for remote radio control of RGBs. In this mode, an AM guidance signal of up to 12 Watts is transmitted.

After 1984, it was planned to install the various systems in the modernized P-3C ORION; a sonobuoy system, including the AN/UYS-1 PROTEUS, a new processor for processing acoustic data, with a display (this is already installed on the VIKING S-3B carrier based ASW aircraft, the AN/USQ-78 control system, the AN/ASH-33 digital magnetophone, and the AN/ARR-78 acoustic signal receiver. This whole equipment complex permits analysis of up to 99 sonobuoy radio channels in the 136-174 MHz band compared to 31 in the 164-174 MHz band in previous systems. An improved processor processes acoustic signals and determines whether a given received signal is from an underwater target or from sea noise. Information from the sonobuoy is displayed on two screens in graphic format using the SP-901 aircraft computer.

To increase the accuracy of determining the location of sonobuoys ejected into the water, accounting for drift, an on board antenna system, the ACPA (Adaptive Control Phased Array), comprised of four antennas, is used.

An operator, using the AP-901 computer, controls the functions of the ACPA system.

For training and practice of the operators in the onboard equipment package, there is a block which simulates signals acquired from sonobuoys on all 99 radio channels (from passive and active buoys and bathythermographs).

The sea-based VIKING S-3A ASW aircraft entered U.S. Navy service in 1974. It is equipped with search equipment which is part of the A-NEW system, along with piloting-navigation equipment. All the components of this system are linked to the AN/AYK-10 general purpose computer. It stores information on probable submarine detection areas, target types, weapons, sonobuoy working frequencies, and it works out data for echo reflection, computes target location and that of the released buoys, processes information received from the buoys and records acquired data. The computer is capable of processing 21 channels and projecting the information on 4 equipment displays.

The signals from 16 buoys are acquired simultaneously on the 31-channel AN/ARR-76 receiver and then on the AN/ASH-27 tape recorder and the AN/AQA-7 processing group with the OL-82/A acoustic processor where they are changed from analog to digital form and recorded on the recording unit's magnetic drum. The AN/ASH-27 recorder logs the analog raw acoustic signals from the 16 channels and the direction of the received emission. Included in the acoustic information equipment group are systems for simultaneous display of data received from all sonobuoys at all frequencies, and means to simultaneously control all 16 buoys. Signal spectral analysis is accomplished by the Fast Fourier Transfer Method.

Sonobuoys are released on computer command in conjunction with the AN/ASW-31 autopilot. Manual release is available. There is also equipment for transmitting commands for remote control of active buoys.

The ATLANTIC II land-based patrol aircraft entered the French Navy in 1969. Basic components of the acoustic search system are the DSTA-3B AND DSTV-7Y sonobuoys, the SADANG acoustic processor (The SAJEM computer 15M125F with a 128 K word memory. The latter is analogous to the AQS-901 acoustic processor and replaces the AWS-1 which is on the ATLANTIC I. It is a framework of modular connected components which permits them to be used in various combinations on ASW aircraft and helicopters.

Two groups of signal processing equipment in differing variants of processing subsystems and eight receivers permit simultaneous processing of signals from eight buoys, and permits classification and determination of the submarine's location. Demodulated signals are processed in analog format and then in digital. The processing style depends on the buoy type, and its operating mode which is selected by an operator. For example, there is a mode of operation for listening simultaneously to signals from two buoys (one in each earphone). Actual target detection and the accuracy of its classification depends on the operator's training.

Signals which are displayed on the screen can, at the same time, be recorded on the recorder's paper tape on four channels simultaneously, fully depicting the sequence of the search. The recorder permits the detection of signals which appear and fade at cyclic time intervals.

Search data in the volume of several "pages" simultaneously enters the onboard computer's memory. According to the wishes of the operator, the display screen can show any "page" of information containing spectral analysis results of acoustic signals on various frequency bands over any time interval.

A wideband, 28-channel magnetophone is also in this equipment package, as well as a system for remote control of active omnidirectional and directional sonobuoys, and an acoustic signal source for equipment checkout. The active buoys are controlled through equipment connected to a transmitter tuned to the buoys' frequencies. The character of the buoy's radiated signal can change with distance: sonar signals are an unbroken series of impulses or single impulses of great length, or abbreviated. Coordinates of the submarine are determined relative to the sonobuoy which is subject to drift, thus, in order to update information about the sonobuoy's location, they are sequentially overflown and bearings are taken using Radio DF. Data acquired in this way is displayed on the screen.

The Canadian Navy is equipped with the Lockheed-built CP-140 AURORA shore based patrol aircraft, based on the U.S. P-3C ORION. Signals received from sonobuoys are processed by an acoustic processor almost identical to that which is installed on the VIKING S-3A carrier-based ASW plane. Precise locations of released buoys is determined by the American-made AN/ASR-2 system. Data entered into the processor is processed in digital form and stored on magnetic tape. Ten of the CP-140 aircraft have the A-NEW system installed.

The Royal Navy has operational command of the NIMROD MK2 shore-based patrol aircraft. Onboard equipment includes an AQS-901 equipment set for processing acoustic signals. Each of these is capable of processing signals received simultaneously from 8 sonobuoy systems BARRA (Australia); CAMBS, JEZEBEL (Great Britain); TANDEM (Canada); DICASS, DIFAR or RANGER (Great Britain/USA).

The AQS-901 processor separates the necessary information from the background noise as well as signal frequency even in a condition of significant random noise volume. At an operator's command, the information received is shown on one of five displays and on the recorder. The AQS-901 is tied to an 8-channel receiver control system for buoy signals. Each receiving channel is tuned to 99 separate radio frequencies in the 140-176 MHz band, which enables simultaneous observation of various sections of the sonobuoy field. The AQS-901 processor operates in real time, processing signals input from the multihydrophone acoustic system of modern sonobuoys. Maximum use is made of digital processing of input information on the forming of acoustic beams of the sonobuoy during spectral analysis and analysis of power in a wide frequency band. The processor determines the exact location of the submarine using passive sonobuoys by means of hyperbolic processing of received bearings and by doppler frequency processing. If necessary, it is possible to use active buoys in this system.

The development of airborne acoustic systems at a glance seems to demonstrate strong preparations by the NATO Navies for anti-submarine warfare on all possible oceans and seas, which they are converting into platforms for their aggressive actions.

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